



## The Cystiscidae (Caenogastropoda) from upper reef formations of New Caledonia

### Los Cystiscidae (Caenogastropoda) de las formaciones superiores de coral de Nueva Caledonia

Franck BOYER\*

Recibido el 16-I-2003. Aceptado el 14-III-2003

#### ABSTRACT

The species of Cystiscidae from the New Caledonian upper reef formations are studied on the ground of recent intensive recolts managed by Paris Museum, mainly the ones from Noumea 1992-93, from the Expedition Montrouzier 1993 and from the Expedition Lifou 2000. The taxonomic analysis is focused on the morphs sampled off New Caledonia mainland (northern and southern areas). The marginellids collection of Bavay recently deposited in Paris Museum is used for the revision of several taxa.

Twenty eight morphs are recognized, among which five are attributed to species previously described, namely *Gibberula lifouana* (Crosse, 1871), *Cystiscus goubini* (Bavay, 1922), *C. montrouzieri* (Bavay, 1922), *C. bougei* (Bavay, 1917) and *Plesiocystiscus tomlini* (Bavay, 1917), the last one with much reserve. The syntypes of *Gibberula pulchella* (Kiener, 1834) are pictured and the species is compared to a New Caledonian relative.

Eighteen species are described as new: *Gibberula squamosa* sp. nov., *G. cincta* sp. nov., *Crithe caledonica* sp. nov., *C. gofasi* sp. nov., *Cystiscus viridis* sp. nov., *C. punctatus* sp. nov., *C. aurantius* sp. nov., *C. marshalli* sp. nov., *C. boucheti* sp. nov., *C. camelopardalis* sp. nov., *C. minor* sp. nov., *C. pardus* sp. nov., *C. deltoides* sp. nov., *C. caeruleus* sp. nov., *C. tricinctus* sp. nov., *C. pseudoaurantius* sp. nov., *C. cooverti* sp. nov., *Plesiocystiscus bavayi* sp. nov.

Five morphs are recorded as potential new species and provisionally referred as *Gibberula* sp. aff. *philippii* (Monterosato, 1878) (morphs A, B and S), *Cystiscus* sp. 1 and *Plesiocystiscus* sp. aff. *bavayi* sp. nov.

Despite the high diversity reported about the group *Crithe/Cystiscus* in shallow waters of New Caledonia mainland, this diversity is appreciated as remaining much underestimated. This diversity cannot be considered as restricted to the New Caledonian waters and equivalent intensive collecting efforts in other places from West Pacific might possibly yield equivalent results.

The genera *Crithe* and *Cystiscus* show as belonging to a continuous complex of related forms, but the taxonomic unification of the group waits for a better knowledge of its total diversity, allowing to propose appropriate subdivisions.

On the ground of the concrete limits met with the taxonomic interpretation, it is suggested that the managing of systematic observations in the field about micro-habitats and about the variability of the soft parts would highly increase the scientific profitability of intensive malacological samplings.

\* 110 chemin du Marais du Souci, 93270, Sevran, France. e-mail: Franck.Boyer6@wanadoo.fr

## RESUMEN

Las especies de Cystiscidae de la parte superior de las formaciones arrecifales de Nueva Caledonia son estudiadas en base a las recientes recolecciones intensivas dirigidas por el Museum de Paris, principalmente las de Noumea 1992-93, la Expedition Montrouzier 1993 y la Expedition Lifou 2000. El análisis taxonómico se centra principalmente en los morfos obtenidos fuera de New Caledonia (areas del norte y sur). La colección de margínélidos de Bavay, recientemente depositada en el Museum de Paris ha sido usada para la revisión de varios taxones.

Se reconocen veintiocho morfos, entre los cuales cinco son atribuidos a especies previamente descritas, como *Gibberula lifouana* (Crosse, 1871), *Cystiscus goubini* (Bavay, 1922), *C. montrouzieri* (Bavay, 1922), *C. bougei* (Bavay, 1917) y *Plesiocystiscus tomlini* (Bavay, 1917), aunque este último con muchas reservas. Los sintipos de *Gibberula pulchella* (Kiener, 1834) son mostrados y la especie es comparada con una similar de Nueva Caledonian.

Diez y ocho especies son descritas como nuevas: *Gibberula squamosa* sp. nov., *G. cincta* sp. nov., *Crithe caledonica* sp. nov., *C. gofasi* sp. nov., *Cystiscus viridis* sp. nov., *C. punctatus* sp. nov., *C. aurantius* sp. nov., *C. marshalli* sp. nov., *C. boucheti* sp. nov., *C. camelopardalis* sp. nov., *C. minor* sp. nov., *C. pardus* sp. nov., *C. deltooides* sp. nov., *C. caeruleus* sp. nov., *C. tricinctus* sp. nov., *C. pseudoaurantius* sp. nov., *C. cooverti* sp. nov., *Plesiocystiscus bavayi* sp. nov.

Cinco morfos son presentados como potenciales especies nuevas y provisionalmente descritos como *Gibberula* sp. aff. *philippii* (Monterosato, 1878) (morphs A, B y S), *Cystiscus* sp. 1 y *Plesiocystiscus* sp. aff. *bavayi* sp. nov.

A pesar de la alta diversidad citada para el grupo *Crithe/Cystiscus* principalmente en aguas superficiales de Nueva Caledonia, probablemente esta diversidad esté todavía infravalorada. Sin embargo, esta diversidad no puede ser considerada restringida a las aguas de Nueva Caledonia ya que una recolección intensiva equivalente en otras zonas del Pacífico occidental posiblemente podría dar similares resultados.

Los géneros *Crithe* y *Cystiscus* muestran como vienen a ser un complejo continuo de formas relacionadas entre sí, pero la unificación taxonómica del grupo queda pendiente de un mayor conocimiento de su completa diversidad, permitiendo así proponer adecuadas subdivisiones.

Basándonos en los límites encontrados con las interpretaciones taxonómicas, se sugiere que la realización sistemáticas de las observaciones de campo acerca de los microhábitats y de la variabilidad de las partes blandas aumentaría el provecho científico de los muestreos intensivos.

KEY WORDS: Cystiscidae, *Gibberula*, *Crithe*, *Cystiscus*, *Plesiocystiscus*, New Caledonia, reef formations, sublittoral zone, diversity, soft parts chromatism.

PALABRAS CLAVE: Cystiscidae, *Gibberula*, *Crithe*, *Cystiscus*, *Plesiocystiscus*, Nueva Caledonia, formaciones arrecifales, zona sublittoral, diversidad, cromatismo de partes blandas.

## INTRODUCTION

The malacologic prospecting of New Caledonia began around 1850 with the recollects made by the R. P. Montrouzier and was developed through the contribution of cultured local collectors, often in link with experimented

European students. In these conditions, the malacological fauna from New Caledonia had become at the beginning of the XX<sup>th</sup> century one of the best known, as far as tropical latitudes are concerned.

After a period of lower activity begun around 1910, this malacologic prospecting was revived at a high level since the seventies, first about landsnails and littoral marine mollusks, soon about deep bathyal levels, leading to the discovery of a highly diversified fauna.

The boosting of this malacologic prospecting of New Caledonia is mainly due to the sustained initiatives of Paris Museum (MNHN), and of the local branch of IRD (ex-ORSTOM). Besides the managing of regular campaigns of sampling at bathyal levels, the organization of two expeditions devoted to the fauna from upper reef formations yielded intensive recolts from Northern New Caledonia (Expedition Montrouzier 1993 to Touho, NE of New Caledonia, and Koumac, NW of New Caledonia) and from Lifou Island (Expedition Lifou 2000). These important recolts, complementary to that ones made earlier around Noumea, are stored now in Paris Museum and allow the revision of the New Caledonian sublittoral mollusks on the ground of a representative material.

This article is devoted to the study of Cystiscidae (Caenogastropoda) from upper sublittoral levels of the New Caledonian mainland, among which the genus *Cystiscus* displays an original high diversity.

The marginelliform gastropods from New Caledonia were not subject to a revision work since the article of BAVAY (1922) devoting a first section (p. 57-65) to the "Marginelles de l'archipel calédonien" (including Loyalty Islands). BAVAY (1922) did recognize the occurrence of eight morphospecies of Cystiscidae, among which only three were attributed to species originally described from the New Caledonian archipelago.

On the ground of the bicolor banded animals of two sibling species of *Cystiscus* respectively recorded from Mascarene Islands and from Society Islands, and of the original radula observed in the first one, BOYER (in press b) suggested that several supraspecific natural groups may well be distinguished within the genus *Cystiscus*. The docu-

mentation displayed in the present article may help to future tentatives leading to a new taxonomic organization of the much diversified group *Crithe/Cystiscus*.

Due to the imprecise limits recognized between the genera *Crithe* and *Cystiscus*, and to the lack of control of the radulae which would allow to separate the *Plesiocystiscus* species on the ground of their full rachiglossan triplated radular system, the attributions proposed herein to these three genera must be considered as provisional. The systematics of the family Cystiscidae is here understood sensu COOVERT AND COOVERT (1995).

## MATERIAL AND METHODS

The studied material belongs to the MNHN collections and comes principally from three sources:

The recolts made by P. Bouchet (MNHN) around Noumea (SW of New Caledonia) during the years 1992-93.

The recolts made by the Reef Biodiversity Workshop organized in Touho and Koumac from August to October 1993 (Expedition Montrouzier, NE and NW of New Caledonia).

The recolts made by a second workshop organized in Lifou Island (Expedition Lifou 2000, Loyalty, east off New Caledonia).

Noumea, Touho and Koumac are mainland sites with a coral lagoon within a barrier reef, which is lacking in Lifou. Koumac and Noumea are on the leeward side of the mainland island whereas Touho is on the windward side, with much resulting differences in terms of hydrodynamism and sediment types (P. Bouchet, pers. comm.).

The sampling was mainly based on advanced technics used by diving, like suction-pipe (air system) and brushing boulders and slabs on a basket-box. These technics were specially applied to the collect of the cryptic micro-fauna inhabiting the coral formations, which appear as sheltering the largest diversity at the upper sublittoral levels (0-40 m).

Some dredgings and trawlings have also been performed in 20-100 m.

A part of the collected material was observed in live state. Many species of Cystiscidae were drawn by P. Bouchet (Noumea) and by S. Gofas (Touho and Koumac). A selection of the Gofas sketches was presented without tentative identifications in BOUCHET (1994). Bouchet's drawings are adapted herein by the author; Gofas' drawings are reproduced in their original state.

Except for few specimens conserved in alcohol, the material was dried station by station. Most of the stations were sorted out later by morphospecies. G. Covert examined most of the material from Touho and Koumac, and did try a further selection, labelling provisional determinations.

The northern area of "Grande Terre" (mainland of New Caledonia) must be considered on the whole as the most documented by these campaigns, the surroundings of Noumea being not so intensively sampled, and the recolt from Lifou being not the subject of live observations and drawings. So, the present work is focusing on the data at hand from the New Caledonian mainland.

In most cases, the environment field data given for each station do not allow to infer what is the micro-habitat in which the subjects were sampled. Some environment labels express a somewhat homogeneous habitat and can be used as such; that is the case for instance in definitions such as: "fine sand", "detritic sand", "sandy silt on rocky floor", "brushing of boulders". But in the main cases, the environment labels mention ambiguous habitat situations (such as "outer slope", "slopes with silt", "vertical slopes and overhang", "succion-pipe on hard bottoms", in which the sampling may concern coral alveolus as well

as detritic or sandy pockets) or heterogeneous habitat compositions (such as "hard bottoms, grass", "boulders, sand, grass", "sand, detritic domes", "succion-pipe on rocks, sargasses collect"). In these ambiguous or heterogeneous situations, the habitat of the subject at hand is considered as "non-recorded".

In the course of this work, several types of Bavay, considered as lost (ROTH and COAN, 1973), were found by the author within the Desjardins collection, deposited in Paris Museum on September 1999 and containing the whole Bavay's marginellid collection (purchased by M. Desjardins to G ret's widow during the thirties). The rediscovery of these types does allow to reassess some cystiscid species whose status remained uncertain.

#### Abbreviations:

- NC: New Caledonia
- AMS: Australian Museum, Sydney
- IRD: Institut de Recherche pour le D veloppement, Paris (ex-ORSTOM)
- IRSNB: Institut Royal des Sciences Naturelles de Belgique, Bruxelles
- MNHG: Mus m national d'Histoire naturelle de Gen ve
- MNHN: Mus m national d'Histoire naturelle, Paris
- NMNZ: National Museum of New Zealand
- NSMT: National Science Museum, Tokyo
- FBC: author's collection
- MDC: Maxime Desjardins collection
- ad: adult
- fr: fragment
- juv: juvenile
- sh: dead collected subject
- spm: live collected subject
- stn: station
- subad: subadult

## RESULTS

### Family CYSTISCIDAE Stimpson, 1865 Genus *Gibberula* Swainson, 1840

Type species: *Gibberula zonata* Swainson, 1840 = *Volvaria oryza* Lamarck, 1822, by monotypy.

*Gibberula squamosa* sp. nov. (Figs. 5-8, 23)

**Type material:** Holotype (Figs. 5, 6, 23) in MNHN Touho, stn 1269. Numerous paratypes (ad/juv, spm/sh) from the type locality in MNHN; 2 ad spm in AMS; 2 ad spm in NMNZ; 2 ad spm in NSMT.

**Other material studied:** Noumea, 1992: stn 1339, 22° 21.9' S, 166° 15.4' E, 20 m, 6 ad spm, 1 juv spm; Great Reef Aboré, 22° 22.26' S, 166° 15.92' E, 12-37 m, 4 ad spm, 1 juv spm; stn 1355, 22° 18.9' S, 166° 26.6' E, 7-10 m, 1 ad sh.

Expedition Montrouzier, Touho, 1993: stn 1237, 20° 46.9' S, 165° 13.8' E, 0-1 m, 4 ad spm, 2 juv spm, 1 ad sh; stn 1251, 20° 46.0'-20° 46.5' S, 165° 13'-165° 14.5' E, 6-15 m, 1 ad sh; stn 1270, 20° 45' S, 165° 16.5' E, 10-35 m, numerous spm and sh; stn 1272, 20° 49.5' S, 165° 19.6' E, 10 m, numerous spm; stn 1273, 20° 50.4' S, 165° 22.8' E, 20 m, numerous spm and sh.

Expedition Montrouzier, Koumac, 1993: stn 1312, 20° 40.4' S, 164° 14.9' E, 26-40 m, 1 ad spm; stn 1319, 20° 44.7' S, 164° 15.5' E, 15-20 m, 1 juv sh; stn 1323, 20° 40.9' S, 164° 14.8' E, 82-120 m, 1 juv sh.

Expedition Lifou 2000: stn 1435, 20° 55.2' S, 167° 00.7' E, 5-30 m, 8 ad sh (Figs. 7, 8), 3 juv sh.

**Type locality:** Touho area, Doiman Reef, stn 1269, 20° 35.1' S, 165° 08.1' E, 15-20 m, outer slope.

**Etymology:** From the scale aspect presented by the shell decoration of rounded and connected axial convolutions.

*Shell description* (Figs. 5, 6): Short, solid, rounded oval. Spire flat, faintly umbilicate, aperture narrow, moderate siphonal notch, four distinct columellar plaits and a faintly distinct fifth upper one. Lip not distinctly denticulate, fine spiral lirations on the inner wall of the outer lip. Outer lip angular, not marginate.

Axial decoration of very sinuous brown lines on a creamy ground, making six blunted convolutions oriented towards the left. Axial lines thickened at the level of the central intervals, suggesting a darker central spiral zone. Less distinct dark spiral zones occur at the upper and lower level of the axial convolutions, which are merging into whitish zones at both tips.

*Size:* 4.25 x 2.80 mm.

*Animal description* (Fig. 23): Bifurcated head, long tentacles and siphon, foot large and flat. Head, siphon and foot decorated with large yellowish patches and small orange stains. The centre of the head lobes and the central part of the metapodium are greenish. Eyes black. The inner mantle shows alternate zones of yellow, orange and greenish colour.

*Distribution:* Known from the whole NC archipelago, alive from the intertidal to 26, empty shells to 82 m. Abundant in Touho, uncommon in Noumea and Koumac, rare in Lifou.

*Habitat:* Collected on hard bottoms with patchy sediments or sandy film, in silt with dead shells, in fine sands with grass.

*Remarks:* *G. squamosa* sp. nov. shows close similarities with *G. pulchella* (Kiener, 1834) from Australia, which has however a larger, more slender and oblong shell, bearing a decoration of more numerous and sharper axial convolutions. The two syntypes of *G. pulchella* pictured herein (Figs. 1-4) measure respectively 7.9 x 4.5 mm and 7.4 x 4.1 mm (MHNG n° 1152/64), whereas *G. squamosa* does not exceed 5 mm in length. *G. pulchella* seems to be sympatric in its type locality of Sydney with at least one other zigzag ornated species (FBC) of smaller size which looks as closely related to *G. squamosa* and ranges up to South West Australia (FBC). The complex of zigzag ornated *Gibberula* presenting with evidence a great number of species only distinguishable on the basis of subtle differences (BOYER, in press a), we provisionally reserve the name *G. squamosa* to the populations represented in NC, characterized by short shells with a limited number of convolutions, and propose to report the similar Indo-Pacific populations as *G. cf. squamosa*. Shells looking as very similar to the types of *G. pulchella* are found in Norfolk Island (FBC).

*Gibberula lifouana* (Crosse, 1871) (Figs. 9-12)

*Marginella lifouana* Crosse, 1871, p. 205-206. Type figures in Crosse, 1872, pl. II, fig. 2.

**Type material:** 1 syntype (Fig. 9) in MNHN, here selected as lectotype Label: "*Marginella lifouana* Crosse I. Lifou (Loyalty) M. Marie par M.E. Marie typus".

**Other material studied:** Expedition Montrouzier, Touho, 1993: stn 1242, 20° 46.2' S, 165° 14.5' E, tide, 1 ad spm (Fig. 12), 7 juv spm.

Expedition Lifou 2000: stn 1419, 20° 55.6' S, 167° 04.5' E, 5 m, numerous spm and sh; stn 1422, 20° 47.1' S, 167° 07.4' E, 4 m, numerous spm and sh; stn 1424, 20° 54.9' S, 167° 03.0' E, 4m, numerous spm and sh (Figs. 10, 11); stn 1425, 20° 46.8' S, 167° 07.2' E, 4-5 m, numerous spm and sh; stn 1453, 20° 54.6' S, 167° 02.1' E, 21-30 m, 1 ad spm, 4 ad and juv sh.

**Type locality:** Lifou Island, Loyalty.

**Shell description** (Fig. 9): Short, subpyriform. Spire flat, protoconch produced, aperture moderately narrowed, widening to the base, deep siphonal notch, four distinct columellar plaits and faint upper lirations running along the apertural wall. Outer lip smooth, flexuous, angular, not marginate. Axial decoration of sharp angular zig-zag mustard yellow lines on a white ground.

**Size:** 4.5 x 2.8 mm.

**Animal:** Unknown.

**Distribution:** *G. lifouana* is abundant in upper sublittoral levels from Lifou Island. The species seems to be very scarce off NC mainland (one present record from Touho). Alive in 0-21 m, empty shells in 4-21 m.

**Habitat:** *G. lifouana* seems to be restricted to soft bottoms, but it is recorded from rough sands as well as fine silty sediments.

**Remarks:** *G. lifouana* shows a more pyriform shell than the one of *G. squamosa*, with a slightly wider aperture, a deeper siphonal notch, and a small teat-like pointed protoconch, not visible in *G. squamosa*. Both species are principally separable on the ground of their shell decoration, as *G. lifouana* has very angular pointed axial zigzag lines, whereas *G. squamosa* has rounded and blunted convolutions. Any kind of intergrades does not exist, despite the fact that both species have been found sympatrically.

*Gibberula cincta* sp. nov. (Figs. 13-16)

**Type material:** Holotype (Figs. 13, 14) in MNHN, Noumea, stn 1347. Paratypes: 20 ad spm (Figs. 15, 16) + sh and 8 juv spm + sh, in MNHN; 2 ad sh in AMS; 2 ad sh in NMNZ; 2 ad sh in NSMT.

**Other material studied:** Noumea, 1993: stn 1367, 22° 24.3' S, 166° 20.7' E, 10 m, 1 ad sh, 3 juv sh; stn 1368, 22° 24.3' S, 166° 20.7' E, 10 m, 3 ad spm, 1 ad sh, 1 juv sh.

**Type locality:** Noumea area, Great Reef Aboré, stn 1347, 22° 23.6' S, 166° 20.1' E, 10 m, silty sand on rock floor.

**Etymology:** From the spiral ranks of dots ornating the shell.

**Shell description** (Figs. 13, 14): Short, solid, subpyriform. Spire almost absent, small teat-like apex, aperture narrow, deep siphonal notch, four distinct columellar plaits and a faintly distinct fifth upper one. Lip not distinctly denticulate, no visible spiral lirations on the inner wall of the outer lip. Outer lip angular, not marginate.

Spiral decoration of six ranks of small regularly spaced out yellowish brown dots. A brown continuous line underlines the suture and reaches the protoconch.

**Size:** 4.2 x 2.9 mm.

**Animal:** Unknown.

**Distribution:** Known only from the Noumea area, SW coast of NC. Alive and empty shells in 10 m.

*Habitat:* Apparently restricted to soft bottoms, in white sands and silty sand.

*Remarks:* *G. cincta* sp. nov appears as closely allied to *G. lifouana*. The "dotted phase" is also known as occurring as an intraspecific variation in some zigzag ornated species of *Gibberula*. That is for instance the common phase in *Gibberula deburghi* (A. Adams, 1864) from South West Australia, whereas zigzag ornated and intergrading subjects may occur in this species, specially in the northern part of the species distribution (pers. obs.).

The shell outline of *G. cincta* is squatter and more rounded than in *G. lifouana*, with a less flexuous labrum. The number of dots on each spiral rank

in *G. cincta* is higher than the number of left (or right) oriented convolutions tips in *G. squamosa*, and the brown subsutural line does not exist in this species. No kind of intergrading form is observed in sympatric material.

*G. cincta* must be accepted as a species belonging to the zigzag ornated *Gibberula* complex. In the case of *G. cincta*, the tips of convolutions thickness are conserved as perfect points, whereas other species may have conserved homologous marks as "arrow-pointed accents" [that is the case for instance in *Gibberula thomensis* (Tomlin, 1918) from the oceanic islands situated off the coasts of Gabon].

#### *Gibberula* sp. aff. *philippii* (Figs. 17-22, 24-26)

Sorting out the small white-shelled *Gibberula* from Touho and Koumac, G. Covert separated three morphospecies corresponding to the drawings of live animals made in Touho by S. Gofas:

Morph A corresponds to the shell pictured in Figures 17 and 18, whose own animal is pictured in fig. 24 (NC 309). Two similar pictures (NC 136 and NC 310) were performed.

Morph B corresponds to the shell pictured in Figures 19 and 20, whose own animal is pictured in Figure 25 (NC 360).

Morph S corresponds to the shell pictured in Figures 21 and 22, whose own animal is pictured in Figure 26 (NC 614).

G. Covert separated as such many lots of shells from Koumac, and some few from Touho. A re-assessment of this arrangement led to distinguish several homogeneous morphs in some stations, but also to find many intergrades linking these morphs in other places (for shell size as well as shell morphology). A fourth morph from Koumac separated by G. Covert as morph R, presenting a medium-sized ogival shell, also looks as a possible intergrade between the morphs A, B and S.

Even if several species are possibly occurring here, the informations given

by the field sketches of live animals are not sufficient in the present state to define specific unities. All these morphs belong to the "*G. philippii* group" [from the mediterranean *G. philippii* (Monterosato, 1878)], whose species currently show a high variability of the soft parts. For instance morph A, as represented in figures 17 and 18, and in figure 24, perfectly matches the most common form of *G. philippii*, by its shell morphology and size as well as by the chromatism of its soft parts (see in GOFAS, 1990: 129-131, 138). The drawings NC 136 and NC 310 show the same pattern of the soft parts.

On the other hand, the chromatism of the soft parts represented in morph B (Fig. 25) is also found as a frequent variant of the *G. philippii* chromatism, and exceptional cases of melanism may occur too, looking like the sketch attributed to morph S (Fig. 26).

A resolution of the diversity pattern within the "*G. philippii* group" ranging in NC requires a deeper study of the variability of the soft parts correlated with the variability of the shell morphology, on the ground of further field observations.

Genus *Crithe* Gould, 1860

Type species: *Crithe atomaria* Gould, 1860, by monotypy.

*Crithe caledonica* sp. nov. (Figs. 27, 36, 45, 63, 64, 66, 67)

**Type material:** Holotype (Figs. 27, 36) in MNHN, Noumea, stn 1340. 5 paratypes (4 ad spm, 1 juv spm) in MNHN. 1 ad spm in AMS; 2 ad spm in NMNZ; 1 ad spm in NSMT.

**Other material studied:** Noumea, 1992: Great Reef Aboré, 22° 22.21' S, 166° 16.15' E, 15-35 m, 5 ad spm (NC 73), 1 juv spm.

Expedition Montrouzier, Touho, 1993: stn 1259, 20° 44.6' S, 165° 13.7' E, 15-35 m, 1 ad spm (Fig. 67); stn 1269, 20° 35.1' S, 165° 08.1' E, 15-20 m, 5 ad spm (Figs. 45, 64), 1 juv spm.

Expedition Montrouzier, Koumac, 1993: stn 1316, 20° 40' S, 164° 11.2' E, 12 m, 16 ad spm and sh (Fig. 63); stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, 2 ad spm (Fig. 66), 1 ad sh, 6 juv spm; stn 1319, 20° 44.7' S, 164° 15.5' E, 15-20 m, 11 ad spm and sh, 7 juv spm and sh; stn 1331, 20° 40'-20° 40.6' S, 164° 11.2'-164° 12.1' E, 55-57 m, 7 ad sh, 1 juv sh.

Expedition Lifou 2000: stn 1429, 20° 47.5' S, 167° 07.1' E, 8-18 m, 7 ad sh, 4 juv sh; stn 1436, 20° 55.5' S, 167° 04.2' E, 47 m, 2 ad sh; stn 1449, 20° 45.8' S, 167° 01.65' E, 17 m, 1 ad sh; stn 1450, 20° 45.8' S, 167° 01.65' E, 27-31 m, 2 ad sh; stn 1451, 20° 47.3' S, 167° 06.8' E, 10-21 m, 2 ad sh; stn 1454, 20° 56.65' S, 167° 02.0' E, 15-18 m 2 ad sh.

**Type locality:** Noumea area, Tetembia Reef, stn 1340, 22° 21.0' S, 166° 14.0' E, 30 m, outer slope.

**Etymology:** From the widespread distribution of the species around NC mainland.

*Shell description* (Fig. 27): White, short, solid, inflated, rounded subpyriform. Spire excavated with a flat top, aperture widely opening to the base, three distinct anterior columellar plaits and four upper columellar varix on the parietal wall. Inner lip faintly denticulate, shoulder of the outer lip low.

*Size:* 1.9 x 1.3 mm.

*Animal description* (Fig. 36): Bifurcated head with long frontal lobes, foot small and triangular. Frontal lobes and lateral sides ahead of the red eyes are yellow, lateral sides of the head behind the eyes are reddish, borders of the central slit are orange in their frontal part and lighter behind. Eyes red. The

foot is whitish, with mottled white patches on the metapodium, the inner mantle is whitish.

*Distribution:* Known from Noumea, Touho, Koumac and Lifou, the species does range all around the NC-area. Alive from 12 to 30 m, empty shells from 8 to 55 m.

*Habitat:* Not accurately established. Live specimens seem to be associated to reef coral formations in the whole upper sublittoral zone.

*Remarks:* By its very rounded and solid shell and by the original pattern of its spire, *C. caledonica* sp. nov. shows as much distinct from all the other species belonging to the *Crithe/Cystiscus*

(Right page) Figures 1-4: *Gibberula pulchella*, syntypes, 7.9 x 4.5 mm and 7.4 x 4.1 mm, Sydney (MHNG). Figures 5-8: *G. squamosa*; 5, 6: holotype, 4.25 x 2.80 mm, Touho, stn 1269 (MNHN); 7, 8: 4.0 x 2.5 mm, Lifou, stn 1435. Figures 9-12: *G. lifouana*; 9: holotype, 4.5 x 2.8 mm, Lifou (MNHN); 10, 11: 4.2 x 2.7 mm, Lifou, stn 1424; 12: 4.2 x 2.8 mm, Touho, stn 1242. Figures 13-16: *G. cincta*; 13, 14: holotype, 4.2 x 2.9 mm, Noumea, stn 1347 (MNHN); 15, 16: paratype, 4.50 x 3.05 mm, Noumea, stn 1347 (MNHN).

(Página derecha) Figuras 1-4: *Gibberula pulchella*, sintipos, 7,9 x 4,5 mm and 7,4 x 4,1 mm, Sydney (MHNG). Figuras 5-8: *G. squamosa*; 5, 6: holotipo, 4,25 x 2,80 mm, Touho, stn 1269 (MNHN); 7, 8: 4,0 x 2,5 mm, Lifou, stn 1435. Figuras 9-12: *G. lifouana*; 9: holotipo, 4,5 x 2,8 mm, Lifou (MNHN); 10, 11: 4,2 x 2,7 mm, Lifou, stn 1424; 12: 4,2 x 2,8 mm, Touho, stn 1242. Figuras 13-16: *G. cincta*; 13, 14: holotipo, 4,2 x 2,9 mm, Noumea, stn 1347 (MNHN); 15, 16: paratipo, 4,50 x 3,05 mm, Noumea, stn 1347 (MNHN).





complex. The shell size and morphology are very constant.

Whereas the chromatism of the head seems to be somewhat constant (Figs. 36, 63, 64, 66, 67), the ground color of the foot and the inner mantle can vary noticeably. The inner mantle ranges

from dirty white to creamy yellow, light yellow and red, or light orange-red. The foot ranges from dull white to light yellowish or very light reddish.

The species seems to be abundant all around the NC mainland and in Loyalty Islands.

### *Crithe gofasi* sp. nov. (Figs. 46, 65)

**Type material:** Holotype (Figs. 46, 65) in MNHN, Touho, stn 1270.

**Type locality:** Touho area, Great Reef Mengalia, stn 1270, 20° 45' S, 165° 16.5' E, 10-35 m, outer slope

**Etymology:** For Serge Gofas, University of Malaga (Spain), who was a pioneer of the revival of the study of marginelliform gastropods in the recent times, and who devoted to an accurate picturing of New Caledonian marginellids in the field.

*Shell description* (Fig. 46): White, short, solid, inflated, rounded subpyriform. Spire slightly excavated with an undulate top, outer lip much arched with a shoulder much elevated, aperture widely opening to the base, three distinct anterior columellar plaits. Inner lip smooth.

*Size:* 1.55 x 1.10 mm.

*Animal description* (Fig. 65): Bifurcated head with medium size frontal lobes, foot small and triangular.

Head hyalinous with light orange borders, except around and behind the red eyes. The borders of the central slit are darker orange. The foot is whitish translucent, mottled white on the metapodium with a reddish axis. The inner mantle is mottled light reddish and yellow.

*Distribution:* Only known by the holotype from Touho, NE coast of NC mainland. Alive in 10 m.

*Habitat:* Not recorded.

*Remarks:* *C. gofasi* sp. nov. can be considered as a sibling species of *C. caledonica*. The distinct features of *C. gofasi* are a smaller size, a more elevated and arched outer lip, a discoloured zone around and behind the eyes, a reddish axis on the metapodium.

As these special features were not observed in the numerous shells of *C. caledonica* and in the different specimens live pictured from Noumea, Touho and Koumac, and considering the fact that the holotype of *C. gofasi* was collected in close vicinity of *C. caledonica* specimens, a specific distinction can play validly here.

### Genus *Cystiscus* Stimpson, 1865

Type species: *Cystiscus capensis* Stimpson, 1865 (non *Marginella capensis* Krauss, 1848) = *Marginella cystiscus* Redfield, 1870 (nom. nov.), by monotypy.

### *Cystiscus viridis* sp. nov. (Figs. 28, 37)

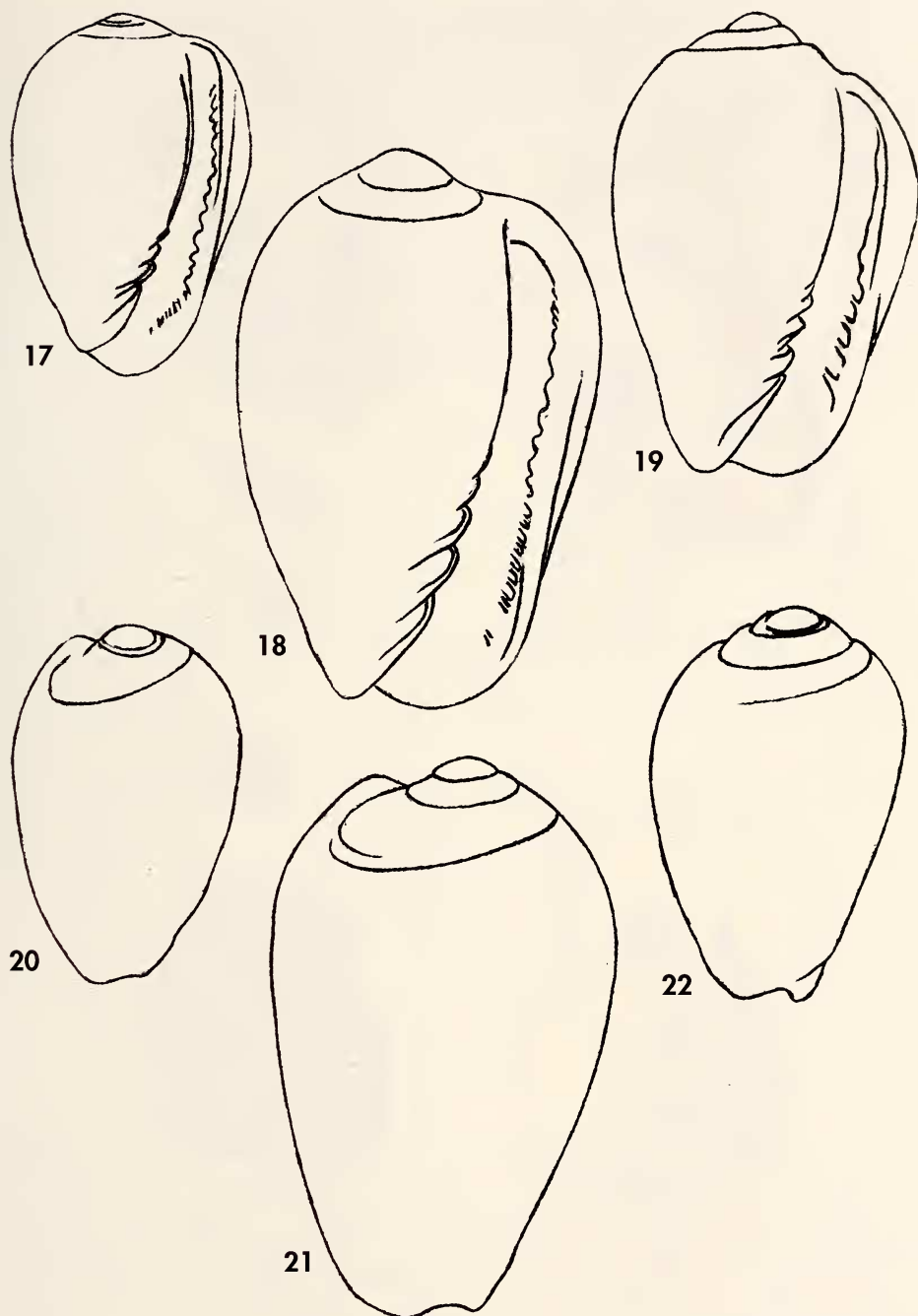
**Type material:** Holotype (Figs. 28, 37) in MNHN, Noumea, stn 1340. 1 paratype (ad spm) from the type locality, in MNHN.

**Type locality:** Noumea area, Tetembia Reef, stn 1340, 22° 21.0' S, 166° 14.0', 30 m, outer slope.

**Etymology:** From the dominant green colour of the animal.

*Shell description* (Fig. 28): Translucent white, short, solid, inflated, rounded subpyriform. Spire very small, rounded

protoconch slightly protuberant, aperture moderately widening to the base, three distinct anterior columellar plaits



Figures 17-22. *Gibberula* sp. aff. *philippii*. 17, 18: morph A, 1.75 x 1.20 mm, Touho, stn 1259; 19, 20: morph B, 2.90 x 1.75 mm, Touho, stn 1271; 21, 22: morph S, 2.35 x 1.50 mm, Touho, stn 1268.

Figuras 17-22. *Gibberula* sp. aff. *philippii*. 17, 18: morfo A, 1,75 x 1,20 mm, Touho, stn 1259; 19, 20: morfo B, 2,90 x 1,75 mm, Touho, stn 1271; 21, 22: morfo S, 2,35 x 1,50 mm, Touho, stn 1268.

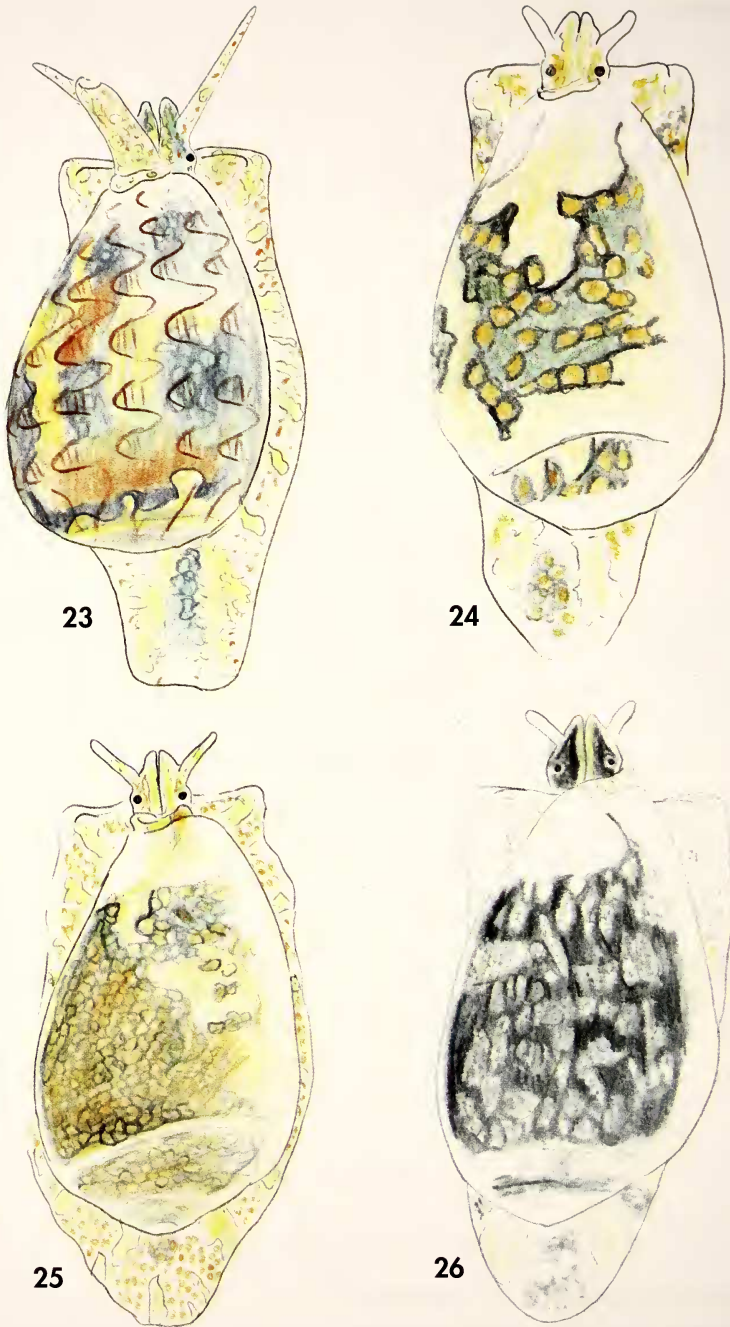


Figure 23: *Gibberula squamosa*, holotype, Touho, stn 1269 (NC 334). Figure 24: *G. sp. aff. philippii* morph A, Touho, stn 1259 (NC 309). Figure 25: *G. sp. aff. philippii* morph B, Touho, stn 1271 (NC 360). Figure 26: *G. sp. aff. philippii* morph S, Touho, stn 1268 (NC 614).  
Figura 23: *Gibberula squamosa*, holotipo, Touho, stn 1269 (NC 334). Figura 24: *G. sp. aff. philippii* morfo A, Touho, stn 1259 (NC 309). Figura 25: *G. sp. aff. philippii* morfo B, Touho, stn 1271 (NC 360). Figura 26: *G. sp. aff. philippii* morfo S, Touho, stn 1268 (NC 614).

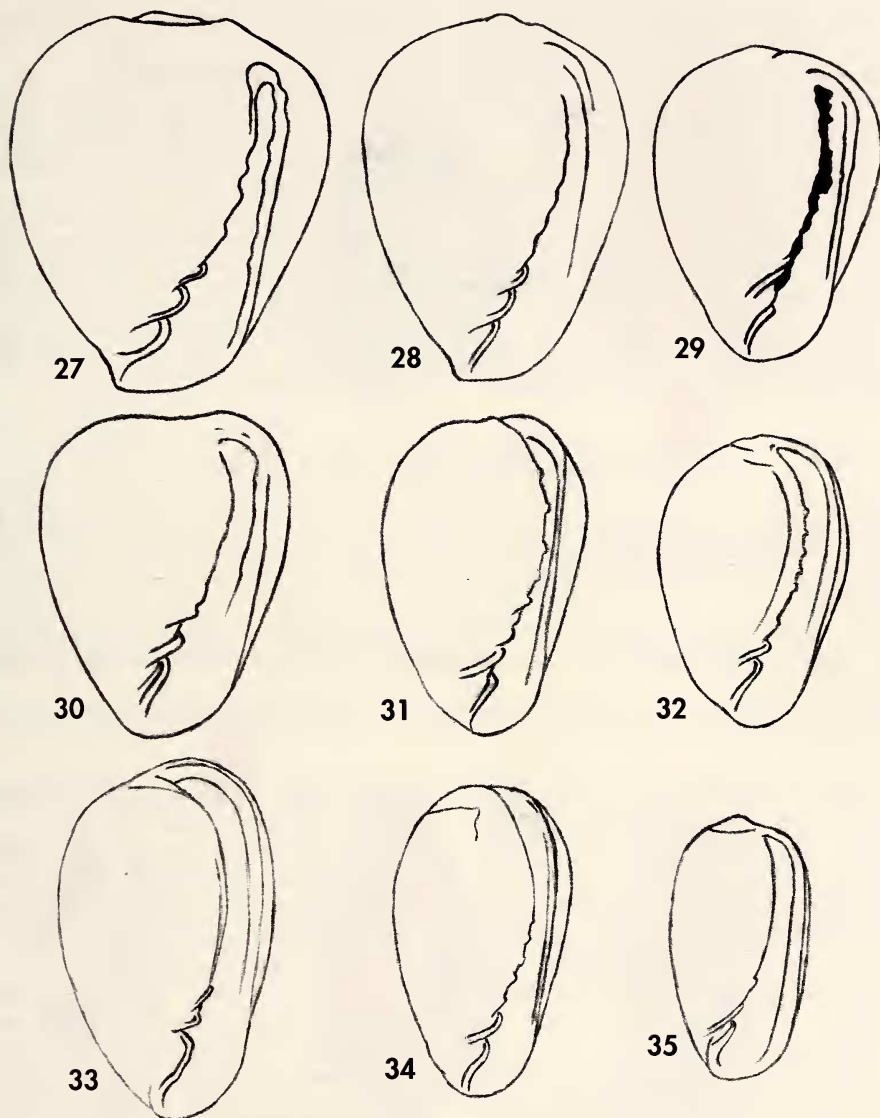


Figure 27: *Crithe caledonica*, holotype, 1.9 x 1.3 mm, Noumea, stn 1340 (MNHN). Figure 28: *Cystiscus viridis*, holotype, 1.85 x 1.10 mm, Noumea, stn 1340 (MNHN). Figure 29: *C. punctatus*, holotype, 1.5 x 1.0 mm, Noumea, stn 1336 (MNHN). Figure 30: *C. aurantius*, holotype, 1.65 x 1.15 mm, Noumea, stn 1340 (MNHN). Figure 31: *C. montrouzieri*, lectotype, 1.55 x 0.95 mm, Lifou (MNHN). Figure 32: *C. montrouzieri*, 1.45 x 0.95 mm, Noumea, stn 1360. Figure 33: *C. marshalli*, holotype, 1.8 x 1.0 mm, Noumea (MNHN). Figure 34: *C. boucheti*, holotype, 1.4 x 0.8 mm, Noumea, stn 1343 (MNHN). Figure 35: *C. camelopardalis*, holotype, 1.3 x 0.7 mm, Noumea, stn 1336 (MNHN).

Figura 27: *Crithe caledonica*, holotipo, 1,9 x 1,3 mm, Noumea, stn 1340 (MNHN). Figura 28: *Cystiscus viridis*, holotipo, 1,85 x 1,10 mm, Noumea, stn 1340 (MNHN). Figura 29: *C. punctatus*, holotipo, 1,5 x 1,0 mm, Noumea, stn 1336 (MNHN). Figura 30: *C. aurantius*, holotipo, 1,65 x 1,15 mm, Noumea, stn 1340 (MNHN). Figura 31: *C. montrouzieri*, lectotipo, 1,55 x 0,95 mm, Lifou (MNHN). Figura 32: *C. montrouzieri*, 1,45 x 0,95 mm, Noumea, stn 1360. Figura 33: *C. marshalli*, holotipo, 1,8 x 1,0 mm, Noumea (MNHN). Figura 34: *C. boucheti*, holotipo, 1,4 x 0,8 mm, Noumea, stn 1343 (MNHN). Figura 35: *C. camelopardalis*, holotipo, 1,3 x 0,7 mm, Noumea, stn 1336 (MNHN).

and six upper visible low columellar varix on the parietal wall. Labrum is somewhat right in its lower part, two profile breakings in the upper part, inner border smooth, low shoulder.

Size: 1.85 x 1.10 mm.

*Animal description* (Fig. 37): Bifurcated head with long frontal lobes, foot small and triangular. Head and foot light green. Eyes red. Inner mantle greenish with creamy white spots, external mantle dark green.

*Distribution*: Only known by two specimens from the same sampling in

Noumea, SW coast of NC mainland. Alive in 30 m.

*Habitat*: Not recorded.

*Remarks*: *C. viridis* sp. nov. is distinct from its relatives by its large tear-shaped shell and by the green chromatism of its animal.

*C. viridis* may be closely related to *Cystiscus iota* (Hedley, 1899) from Funafuti (Ellice Islands), which presents a more slender and narrowed shell, a more sinuous and somewhat elevated labrum, and a longer and sinuous first columellar plait.

### *Cystiscus punctatus* sp. nov. (Figs. 29, 38, 73)

**Type material**: Holotype (Figs. 29, 38) in MNHN, Noumea, stn 1336. Paratypes: 1 subad and 2 juv spm from the type locality, in MNHN.

**Other material studied**: Noumea, 1992: Great Reef Aboré, 22° 22.21' S, 166° 16.15' E, 15-35 m, 2 ad spm.

Expedition Montrouzier, Koumac, 1993: stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, 2 juv spm (Fig. 73).

**Type locality**: Noumea area, Ile aux Canards, stn 1336, 22° 19.0' S, 166° 26.1' E, 18 m, boulders and sargasses.

**Etymology**: From the decoration of the inner mantle of the animal, made of black spots on an orange ground.

*Shell description* (Fig. 29): Translucent white, short, solid, moderately inflated, faintly subpyriform. Spire very short, slightly angular, aperture moderately widening to the base, three distinct anterior columellar plaits. Outer lip very arched in its upper part, straighter in its lower part, inner lip straight and rather smooth.

Size: 1.5 x 1.0 mm.

*Animal description* (Fig. 38): Bifurcated head with long frontal lobes, foot small and triangular. Head and foot

deep orange. Eyes red. Inner mantle orange with black spots.

*Distribution*: Only known from two lots from Noumea and one lot from Koumac, both localities situated on the west coast of NC mainland. Alive from 15 to 20 m.

*Habitat*: Not recorded.

*Remarks*: *C. punctatus* sp. nov. is distinct from its relatives by its orange animal spotted with black on the inner mantle. The shell, even if smaller, shows some similarities with that ones of *C. viridis* and of *C. goubini* (Bavay, 1922) (cf. *infra*).

### *Cystiscus aurantius* sp. nov. (Figs. 30, 39)

**Type material**: Holotype (Figs. 30, 39) in MNHN, 1.65 x 1.15 mm. Noumea, stn 1340. 1 paratype (ad spm) from the type locality, in MNHN.

**Other material studied**: Noumea, 1992: Great Reef Aboré, 22° 22.21' S, 166° 16.15' E, 15-35 m, 4 ad and 1 subad spm.

**Type locality**: Noumea area, Tetembia Reef, stn 1340, 22° 21.0' S, 166° 14.0' E, 30 m, outer slope.

**Etymology**: From the general orange shade of the animal.

*Shell description* (Fig. 30): White, short, solid, subtriangular. Spire hidden,

top slightly concave, aperture moderately opening to the base, outer lip

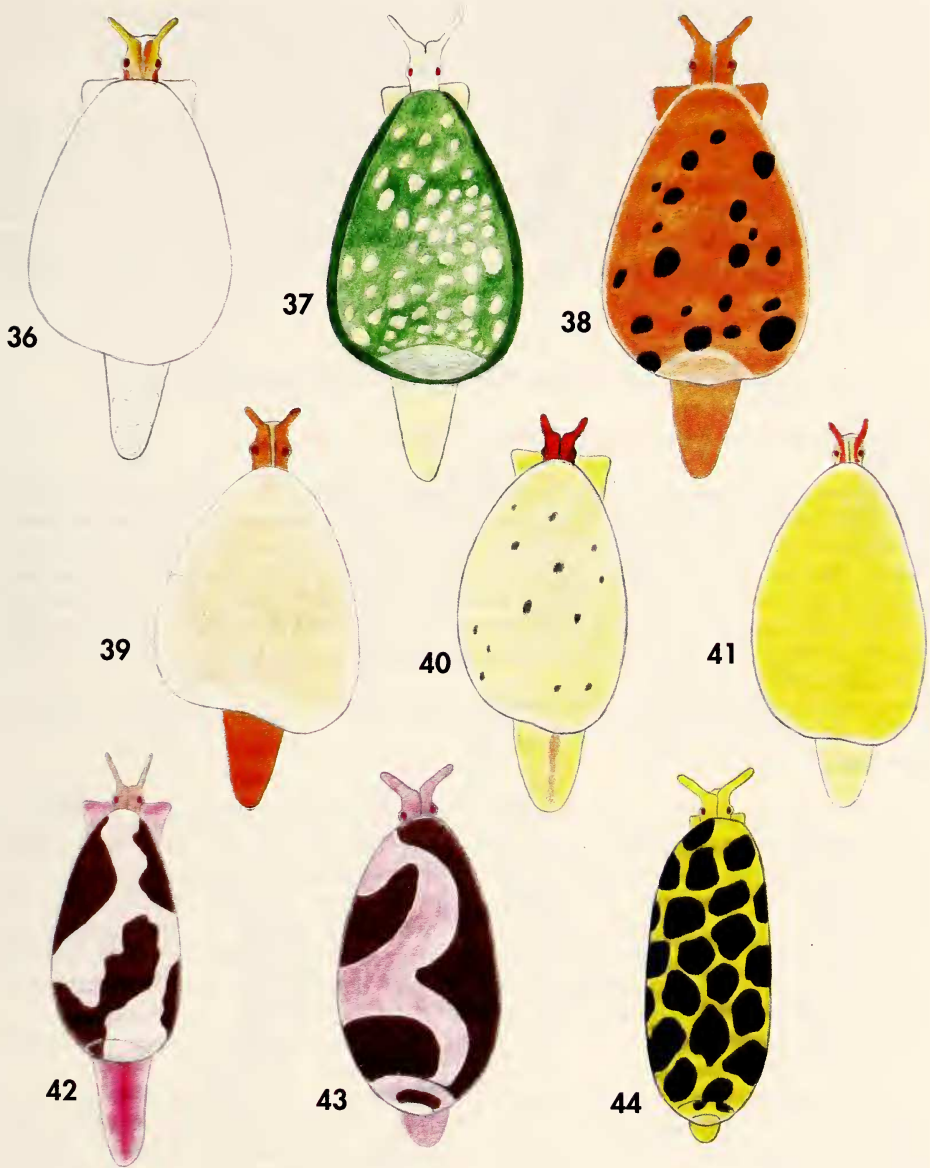


Figure 36: *Crithe caledonica*, holotype, Noumea, stn 1340 (NC 22). Figure 37: *Cystiscus viridis*, holotype, Noumea, stn 1340 (NC 23). Figure 38: *C. punctatus*, holotype, Noumea, stn 1336 (NC 12). Figure 39: *C. aurantius*, holotype, Noumea, stn 1340 (NC 24). Figure 40: *C. montrouzieri*, Noumea, stn 1360 (NC 78). Figure 41: *C. marshalli*, holotype, Noumea (NC 75). Figure 42: *C. boucheti*, holotype, Noumea, stn 1343 (NC 52). Figure 43: *C. sp. 1*, Noumea (NC 14). Figure 44: *C. camelopardalis*, holotype, Noumea, stn 1336 (NC 13).

Figura 36: *Crithe caledonica*, holotipo, Noumea, stn 1340 (NC 22). Figura 37: *Cystiscus viridis*, holotipo, Noumea, stn 1340 (NC 23). Figura 38: *C. punctatus*, holotipo, Noumea, stn 1336 (NC 12). Figura 39: *C. aurantius*, holotipo, Noumea, stn 1340 (NC 24). Figura 40: *C. montrouzieri*, Noumea, stn 1360 (NC 78). Figura 41: *C. marshalli*, holotipo, Noumea (NC 75). Figura 42: *C. boucheti*, holotipo, Noumea, stn 1343 (NC 52). Figura 43: *C. sp. 1*, Noumea (NC 14). Figura 44: *C. camelopardalis*, holotipo, Noumea, stn 1336 (NC 13).

arched in its upper part, with a highly produced shoulder, lower lip rather straight, inner lip almost smooth, three distinct anterior columellar plaits and one small columellar varix just above the third plait.

*Animal description* (Fig. 39): Bifurcated head with medium sized frontal lobes, foot small. Head and foot deep orange. Eyes red. Inner mantle creamy orange.

*Distribution*: Only known from two stations off Noumea, in upper sublittoral. Alive from 15 to 30 m.

*Habitat*: Not recorded.

*Remarks*: *C. aurantius* sp. nov. is distinct from *C. punctatus* by its heartshaped shell as well as the uniform creamy orange inner mantle of its animal, contrasting with the deep orange black spotted inner mantle found in *C. punctatus*.

*Cystiscus montrouzieri* (Bavay, 1922) (Figs. 31, 32, 40)

*Marginella montrouzieri* Bavay, 1922, p. 62-63, pl. I, figs. 4-5.

**Type material**: Lectotype (Fig. 31) and 6 paralectotypes (5 ad and 1 juv sh) in MNHN (ex-MDC). Labels: "*Ma. Montrouzieri* By I. Lifou sables", from the hand of Bavay, and "TYPE" in typed red letters. The specimen recorded as "holotype" (1.5 x 1.0 mm) by ROTH AND CLOVER (1973: 212) is a juv sh, whereas the type figures in BAVAY (1922: pl. 1, figs. 4, 5) show clearly an adult subject. Furthermore, any label does not certify a status of holotype for the shell represented in "Collection du Journal", and this shell may as well belong to a different species than the one described and pictured by Bavay. So this specimen can only be considered as a syntype, and it is designated here as paralectotype n° 7, MNHN.

**Other material studied**: Noumea, 1993: Mberé Reef, stn 1360, 22° 19.9' S, 166° 13.2' E, 10-15 m, 1 ad (Figs. 32, 40) and 1 subad spm.

**Type locality**: Lifou.

*Shell description* (Fig. 31): White, short, narrow, suboval outline tapering to the base, left side much arched, right side angular in its upper part. Spire hidden, aperture high and narrow, inner lip straight, smooth, two strong anterior columellar plaits and six upper small plaits or lirations ranging all along the columellar border.

*Size*: 1.55 x 0.95 mm.

*Animal description* (Fig. 40): Bifurcated head with medium sized frontal lobes, foot small and triangular. Head reddish-orange, eyes red. Foot yellow with a reddish axis on the metapodium. Inner mantle light yellowish with small blackish stains.

*Distribution*: Described from Lifou. The provisional attribution to the species of the form observed in Noumea

deserves to be confirmed by a control of the shell variability and overall of the animal chromatism occurring in Lifou. In Noumea, alive at 10-15 m. BAVAY (1922: 63) records a "very analogous form" from Kermadec Islands. Similar forms were not observed in other places from NC mainland.

*Habitat*: Brushed alive on coral boulders.

*Remarks*: As far as the shell morphology is concerned, *C. montrouzieri* is principally comparable to *C. bougei* (Bavay, 1917) (see infra). It must be underlined that the ad spm from Noumea (Fig. 32) is noticeably different from the typical form, mainly due to the lower rupture of the outer profile of the labrum. However this feature might be representative of an intraspecific variability.

*Cystiscus marshalli* sp. nov. (Figs. 33, 41, 55, 76)

**Type material**: Holotype (Figs. 33, 41) in MNHN. Noumea, Great Reef Aboré. 1 paratype (ad spm) from the type locality, in MNHN.



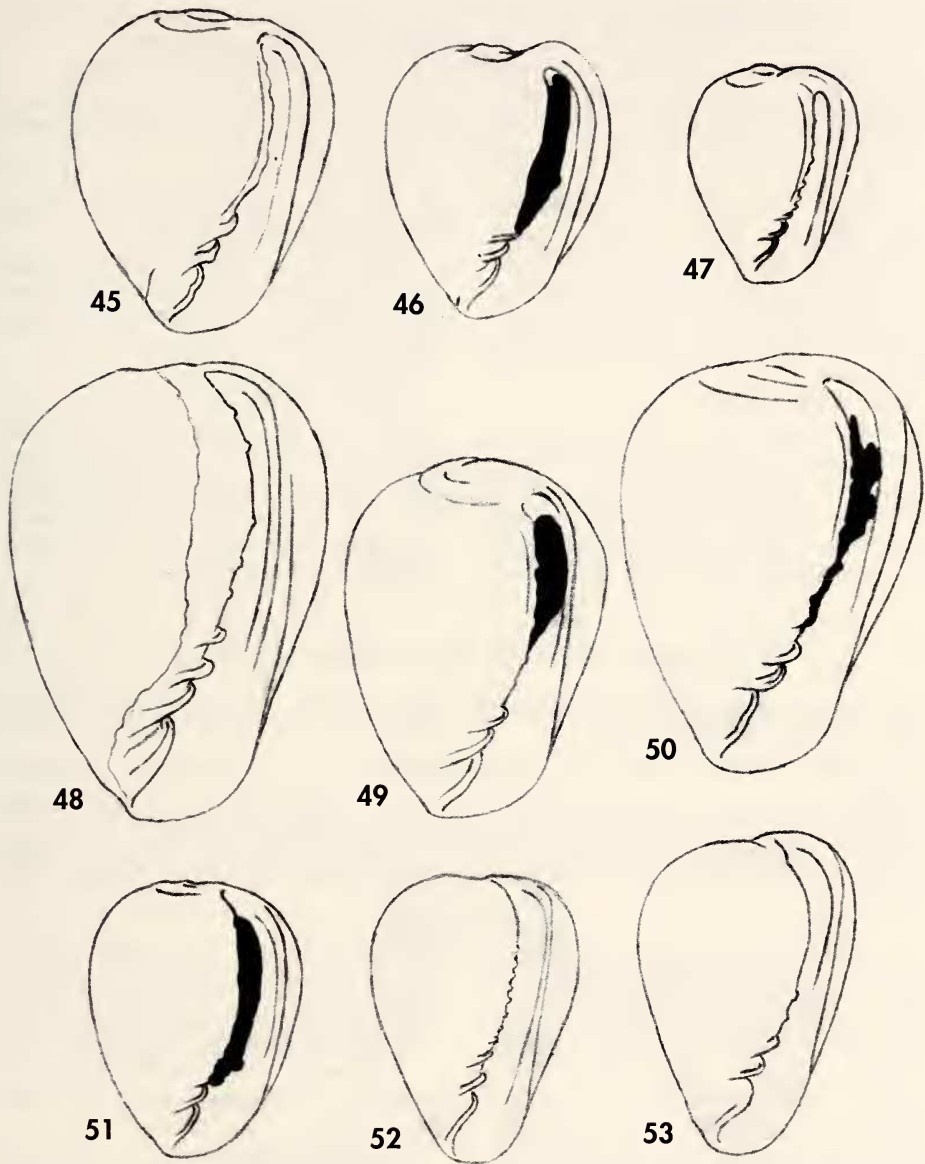


Figure 45: *Crithe caledonica*, 1,75 x 1,30 mm, Touho, stn 1269. Figure 46: *C. gofasi*, holotype, 1,55 x 1,10 mm, Touho, stn 1270 (MNHN). Figure 47: *Cystiscus minor*, holotype, 1,2 x 0,8 mm, Touho, stn 1271 (MNHN). Figures 48-50: *C. goubini*; 48: ex auct, 2,3 x 1,4 mm (MNHN); 49: 2,00 x 1,35 mm, Touho, stn 1269; 50: 1,90 x 1,25 mm, Koumac, stn 1318. Figure 51: *C. pardus*, holotype, 1,55 x 1,00 mm, Koumac, stn 1318 (MNHN). Figure 52: *C. deltoides*, holotype, 1,50 x 0,95 mm, Koumac, stn 1331 (MNHN). Figure 53: *C. caeruleus*, holotype, 1,7 x 1,0 mm, Touho, stn 1270 (MNHN).  
 Figura 45: *Crithe caledonica*, 1,75 x 1,30 mm, Touho, stn 1269. Figura 46: *C. gofasi*, holotipo, 1,55 x 1,10 mm, Touho, stn 1270 (MNHN). Figura 47: *Cystiscus minor*, holotipo, 1,2 x 0,8 mm, Touho, stn 1271 (MNHN). Figuras 48-50: *C. goubini*; 48: ex auct, 2,3 x 1,4 mm (MNHN); 49: 2,00 x 1,35 mm, Touho, stn 1269; 50: 1,90 x 1,25 mm, Koumac, stn 1318. Figura 51: *C. pardus*, holotipo, 1,55 x 1,00 mm, Koumac, stn 1318 (MNHN). Figura 52: *C. deltoides*, holotipo, 1,50 x 0,95 mm, Koumac, stn 1331 (MNHN). Figura 53: *C. caeruleus*, holotipo, 1,7 x 1,0 mm, Touho, stn 1270 (MNHN).

**Other material studied:** Expedition Montrouzier, Touho, 1993: stn 1271, 20° 52.7' S, 165° 19.5' E, 5-25 m, 6 ad spm (Fig. 55); stn 1272, 20° 49.5' S, 165° 19.6' E, 10 m, 1 ad spm (Fig. 76).

Expedition Montrouzier, Koumac, 1993: stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, 1 ad spm.

**Type locality:** Noumea area, Great Reef Aboré, 22° 22.21' S, 166° 16.15' E, 15-35 m, outer slope.

**Etymology:** For Bruce Marshall (NMNZ) who cooperated with P. Bouchet during the Noumea Expedition in November 1992, in which this species was first collected.

*Shell description* (Fig. 33): Translucent white, slender, light, suboval. Spire merged into the insertion of the much elevated labrum. Aperture regularly opened, inner lip smooth, one large first columellar plait and two upper packed small ones.

*Size:* 1.8 x 1.0 mm.

*Animal description* (Fig. 41): Bifurcated head with medium sized frontal lobes, foot small. Head yellow with a long axial reddish band running from each frontal lobe to the base of the head, passing between the eye and the central

slit. Eyes red. Foot light yellow. Inner mantle uniformly deep yellow.

*Distribution:* Known from Noumea, Touho and Koumac, the species is supposed to range all around the NC mainland. Alive from 5 to 20 m.

*Habitat:* Not recorded.

*Remarks:* The shell as well as the animal of *C. marshalli* show as very constant. The animal of *C. montrouzieri* presents some similarities. However the shells of both species are noticeably divergent in several respects, and a close relationship is not evident.

### *Cystiscus boucheti* sp. nov. (Figs. 34, 42)

**Type material:** Holotype (Figs. 34, 42) in MNHN. Noumea, stn 1343. Paratypes 7 ad and 1 subad spm from the type locality, in MNHN.

**Other material studied:** Noumea, 1992: Lagoon, Maitre Islet, 22° 20.41' S, 166° 25.69' E, low tide, 10 ad spm.

**Type locality:** Noumea area, Senez Reef, stn 1343, 22° 17.8' S, 166° 19.9' E, 7 m, inner slope.

**Etymology:** For Philippe Bouchet (MNHN), who led the coastal campaigns which procured the material studied in this article, and who pictured valuable descriptive sketches of live cystiscids in Noumea.

*Shell description* (Fig. 34): Translucent white, light, regular slender oval outline, narrow. Aperture very long and narrow, contracted in its mid-part, no apex. Outer lip thin and smooth, straight in its lower  $\frac{2}{3}$  parts and arched upper. Two first columellar strong plaits, a third one faint, four small columellar varix occupy the half part of the remaining parietal wall.

*Size:* 1.4 x 0.8 mm.

*Animal description* (Fig. 42): Bifurcated head with long frontal lobes, foot small and triangular. Head light pinkish

orange, eyes red. Foot pink with a darker axis on the metapodium. Inner mantle coloured by large packed pinky white and chocolate brown layers.

*Distribution:* Only known from two stations off Noumea. Alive from intertidal to 7 m.

*Habitat:* Not recorded.

*Remarks:* According to the field notes by P. Bouchet, the colour pattern of the animal is much constant, even if the inner mantle is more patchy in some specimens.

### *Cystiscus* sp. 1 (Fig. 43)

In his drawing NC 14 (Noumea area, Ile aux Canards, 18 m, 1992-06-30), P. Bouchet pictured an animal comparable to *C. boucheti*, but showing also some

constant differences even in the one station where both forms were observed as living in micro-sympatry (Senez Reef, 7 m, 1992-09-07). The corresponding

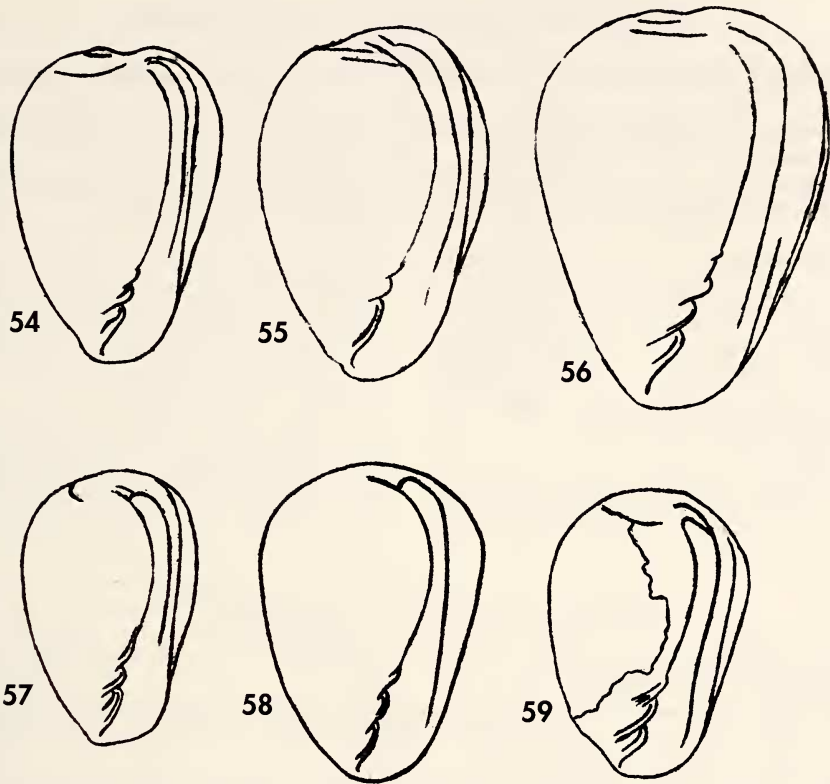


Figure 54: *Cystiscus tricinctus*, holotype, 1.60 x 0.95 mm, Touho, stn 1269 (MNHN). Figure 55: *C. marshalli*, 1.65 x 0.95 mm, Touho, stn 1271. Figure 56: *C. pseudoaurantius*, holotype, 1.9 x 1.3 mm, Touho, stn 1255 (MNHN). Figure 57: *C. cooverti*, holotype, 1.40 x 0.85 mm, Koumac, stn 1312 (MNHN). Figure 58: *C. bougei*, lectotype, 1.4 x 1.0 mm, Wallis (MNHN). Figure 59: *C. bougei*, 1.35 x 0.85 mm, Koumac, stn 1279.

*Figura 54: Cystiscus tricinctus, holotipo, 1,60 x 0,95 mm, Touho, stn 1269 (MNHN). Figura 55: C. marshalli, 1,65 x 0,95 mm, Touho, stn 1271. Figura 56: C. pseudoaurantius, holotipo, 1,9 x 1,3 mm, Touho, stn 1255 (MNHN). Figura 57: C. cooverti, holotipo, 1,40 x 0,85 mm, Koumac, stn 1312 (MNHN). Figura 58: C. bougei, lectotipo, 1,4 x 1,0 mm, Wallis (MNHN). Figura 59: C. bougei, 1,35 x 0,85 mm, Koumac, stn 1279.*

specimens from both stations were packaged separately in the field, but the lots corresponding to *Cystiscus* sp. seem to have been lost later.

*Animal description* (Fig. 43): Bifurcated head with medium size frontal lobes, foot small. Head and foot pink. Eyes red. Inner mantle made of a large alternated zone of chocolate brown and pink, this last zone being bordered by a narrow white fringe.

*Remarks:* In his field notes, P. Bouchet insists on the fact that the colour pattern

of the inner mantle is constant in this form, and that it can be distinguished from *C. boucheti* by several features: its size is smaller, its foot is more uniformly pink coloured, the clear zones of its inner mantle are pink with a white fringe, and not uniformly pinky white.

In these conditions, it can be assumed that two sibling species are occurring here. Waiting for the rediscovery (or new recollects) of *Cystiscus* sp. 1 specimens, this morph is kept as an unnamed species.

*Cystiscus camelopardalis* sp. nov. (Figs. 35, 44)

**Type material:** Holotype (Figs. 35, 44) in MNHN. Noumea, stn 1336. 3 paratypes: 2 ad and 1 juv spm, in MNHN.

**Type locality:** Noumea area, Ile aux Canards, stn 1336, 22° 19.0' S, 166° 26.1' E, 18 m, boulders and sargasses.

**Etymology:** From the chromatism of the soft parts, with black subquadrate patches on a yellow ground, similar to the coat decoration of the giraffe (Latin form = *camelopardalis*).

*Shell description* (Fig. 35): Translucent white, slender cylindrical. Small produced spire, teat-like apex, aperture narrow, moderately widened to the base, labrum straight, inner lip smooth, two long anterior columellar plaits and a faintly produced third one.

*Size:* 1.0 x 0.7 mm.

*Animal description* (Fig. 44): Bifurcated head with long sized frontal lobes, foot

very small and narrow. Head and foot deep yellow, eyes red. Inner mantle deep yellow with deep black irregular slabs.

*Distribution:* Only known by one lot from Noumea area. Alive in 18 m.

*Habitat:* Not recorded.

*Remarks:* By its shell as well as its animal chromatism, *C. camelopardalis* sp. nov. shows as very distinct from all the other species of *Cystiscus*.

*Cystiscus minor* sp. nov. (Figs. 47, 68, 69)

**Type material:** Holotype (Fig. 47) in MNHN. Touho, stn 1271. Paratypes: 8 ad and 1 juv spm from the type locality, in MNHN.

**Other material studied:** Expedition Montrouzier, Touho, 1993: stn 1259, 20° 44.6' S, 165° 13.7' E, 15-35 m, 1 ad spm (Fig. 68); stn 1270, 20° 45' S, 165° 16.5' E, 10-35 m, 4 ad spm; stn 1271, 20° 52.7' S, 165° 19.5' E, 5-25 m, 1 ad spm (Fig. 69).

Expedition Montrouzier, Koumac, 1993: stn 1310, 20° 39.7' S, 164° 14.9' E, 15 m, 3 ad and 1 juv spm; stn 1312, 20° 40.4' S, 164° 14.9' E, 26-40 m, 21 ad and 1 juv spm, 2 ad sh; stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, 2 ad and 1 juv spm.

**Type locality:** Touho area, Tié shallows, stn 1271, 20° 52.7' S, 165° 19.5' E, 5-25 m, cliffs, sand on rocky floor.

**Etymology:** From the small size of the species.

*Shell description* (Fig. 47): Translucent white, short, subtriangular. Spire faintly produced, teat-like protoconch, labrum elevated and arched in its upper part, straight in its central and lower part. Aperture narrow, faintly widening to the base, inner lip smooth, three anterior columellar plaits and seven faint parietal varix.

*Size:* 1.2 x 0.8 mm.

*Animal description* (Fig. 68): Bifurcated head with short frontal lobes, foot small and triangular. Head whitish fringed with light orange, more reddish around the central slit. Eyes red. Foot mottled opaque white. Inner mantle whitish with beige shades.

*Distribution:* Known from Touho and Koumac, in north of the NC mainland. Alive from 5 to 26 m, empty shells at 26 m.

*Habitat:* Not recorded.

*Remarks:* In its northern distribution, *C. minor* sp. nov. seems to be rather common and live in somewhat dense populations.

The shell morphology is constant, but the chromatism of the animal somewhat variable (Figs. 68, 69). The light orange zones on the head periphery may be replaced by creamy yellow zones restricted to the frontal lobes. The reddish fringes may be very narrowed and also restricted to the frontal lobes.

The foot may be mottled light yellow better than white, with a fine red fringe ahead. The inner mantle may be deep white.

About specimens observed from Mangalia Reef (Touho), S. Gofas noted that the head may be "more or less orange".

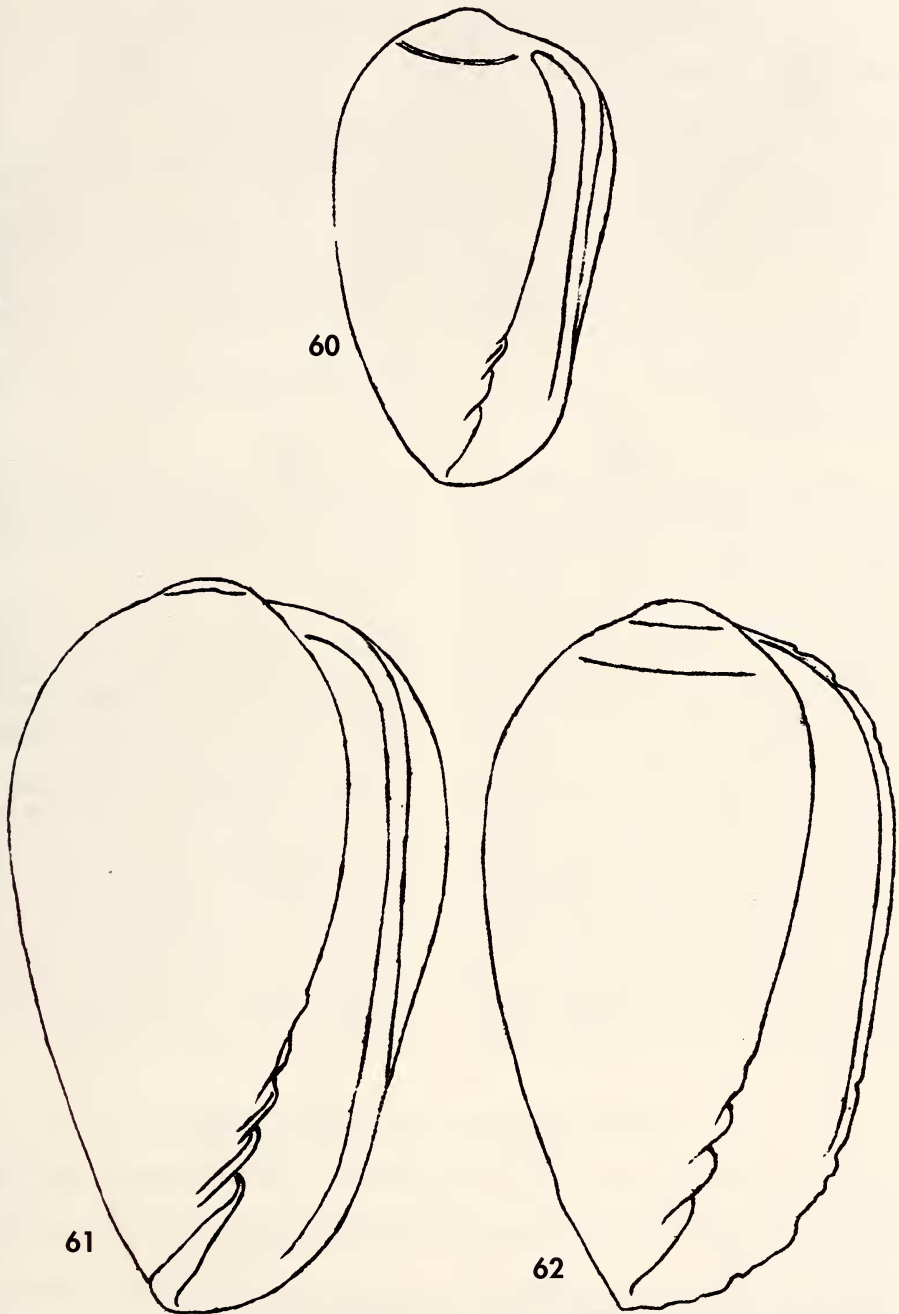


Figure 60: *Plesiocystiscus tomlini*, lectotype, 2.20 x 1.25 mm, Ouvea, Wallis Is. (MNHN). Figures 61, 62. *P. bavayi*. 61: holotype, 3.30 x 1.95 mm, Touho, stn 1261 (MNHN); 62: 3.10 x 1.70 mm, Touho, stn 1271.

Figura 60: *Plesiocystiscus tomlini*, lectotipo, 2.20 x 1.25 mm, Ouvea, Wallis Is. (MNHN). Figuras 61, 62. *P. bavayi*. 61: holotipo, 3.30 x 1.95 mm, Touho, stn 1261 (MNHN); 62: 3.10 x 1.70 mm, Touho, stn 1271.

*Cystiscus goubini* (Bavay, 1922) (Figs. 48-50, 70, 71)

*Marginella goubini* Bavay, 1922, p. 60-61, pl. I, fig. 10

**Type material:** Holotype said to be lost (ROTH and CLOVER, 1973: 211).

**Other material studied:** MDC: 11 ad sh (Fig. 48), labelled "Goubini" from the hand of Bavay.

Expedition Montrouzier, Touho, 1993: stn 1269, 20° 35.1' S, 165° 08.1' E, 15-20 m, 3 ad spm (Fig. 49, 70); stn 1271, 20° 52.7' S, 165° 19.5' E, 5-25 m, 3 juv spm.

Expedition Montrouzier, Koumac, 1993: stn 1299, 20° 34.4' S, 164° 13.0' E, 12-14 m, 1 ad spm; stn 1312, 20° 40.4' S, 164° 14.9' E, 26-40 m, 5 ad and 2 juv spm 2 ad sh; stn 1316, 20° 40' S, 164° 11.2' E, 12 m, 10 ad and 2 juv spm, 4 ad sh; stn 1318, 20° 41.4' S, 164° 14.8' E, 20-40 m, 4 ad and 3 juv spm, 1 ad sh, (Figs. 50, 71); stn 1319, 20° 44.7' S, 164° 15.5' E, 15-20 m, 5 ad and 2 juv spm; stn 1331, 20° 40'-20° 40.6' S, 164° 11.2'-164° 12.1' E, 55-57 m, 1 ad sh.

Expedition Lifou 2000: stn 1429, 20° 47.5' S, 167° 07.1' E, 8-18 m, 1 ad spm, 2 ad sh; stn 1436, 20° 55.5' S, 167° 04.2' E, 10-20m, 4 ad sh; stn 1442, 20° 46.4' S, 167° 02.0' E, 47 m, 2 ad sh.

**Type locality:** Lifou.

**Shell description** (Fig. 48): White, solid, egg-shaped outline, inflated, faintly pyriform. Aperture long and narrow, much widening to the base. Outer lip thick and rounded in its upper part, thin and flexuous in its lower part. Two strong anterior columellar plaits, two next ones fainter, and six regular spaced lirations along the parietal border.

**Size:** 1.9 to 2.3 mm x 1.25 to 1.40 mm.

**Animal description** (Figs. 70, 71): Bifurcated head with medium sized frontal lobes, foot medium sized and triangular. The borders of the head are light orange, more pronounced along the central slit, on a whitish to yellow background. Eyes red. The foot is opaque greyish to dirty white, a fine orange vein may run ahead. Inner mantle greyish blue, paving pattern of irregular figures. External mantle is mottled greyish blue with an irregular surface.

**Distribution:** Known from Lifou (type locality) and from northern NC (Touho and Koumac). Alive from 5 to 26 m, empty shells from 8 to 55 m.

**Habitat:** Hard bottoms.

**Remarks:** The shell of *C. goubini* (Bavay, 1922) is distinct by its large size and its bulbous shape. The animal chromatism differs noticeably from all the other NC species, except from the species considered hereunder.

Due to the poor datum joined to the lot of *C. goubini* found in the Bavay's collection, and to the absence of a "TYPE" label, the status of this lot as type material is not ascertained. The designation of a neotype is provisionally refrained, waiting for the possible rediscovery of such a type lot within a public institution, for instance in the Dautzenberg Collection, IRSNB.

*Cystiscus pardus* sp. nov. (Figs. 51, 72)

**Type material:** Holotype (Figs. 51, 72) in MNHN. Koumac, stn 1318. 1 paratype (ad spm) from the type locality, in MNHN.

**Other material studied:** Expedition Montrouzier, Koumac, 1993: stn 1319, 20° 44.7' S, 164° 15.5' E, 15-20 m, 3 ad spm.

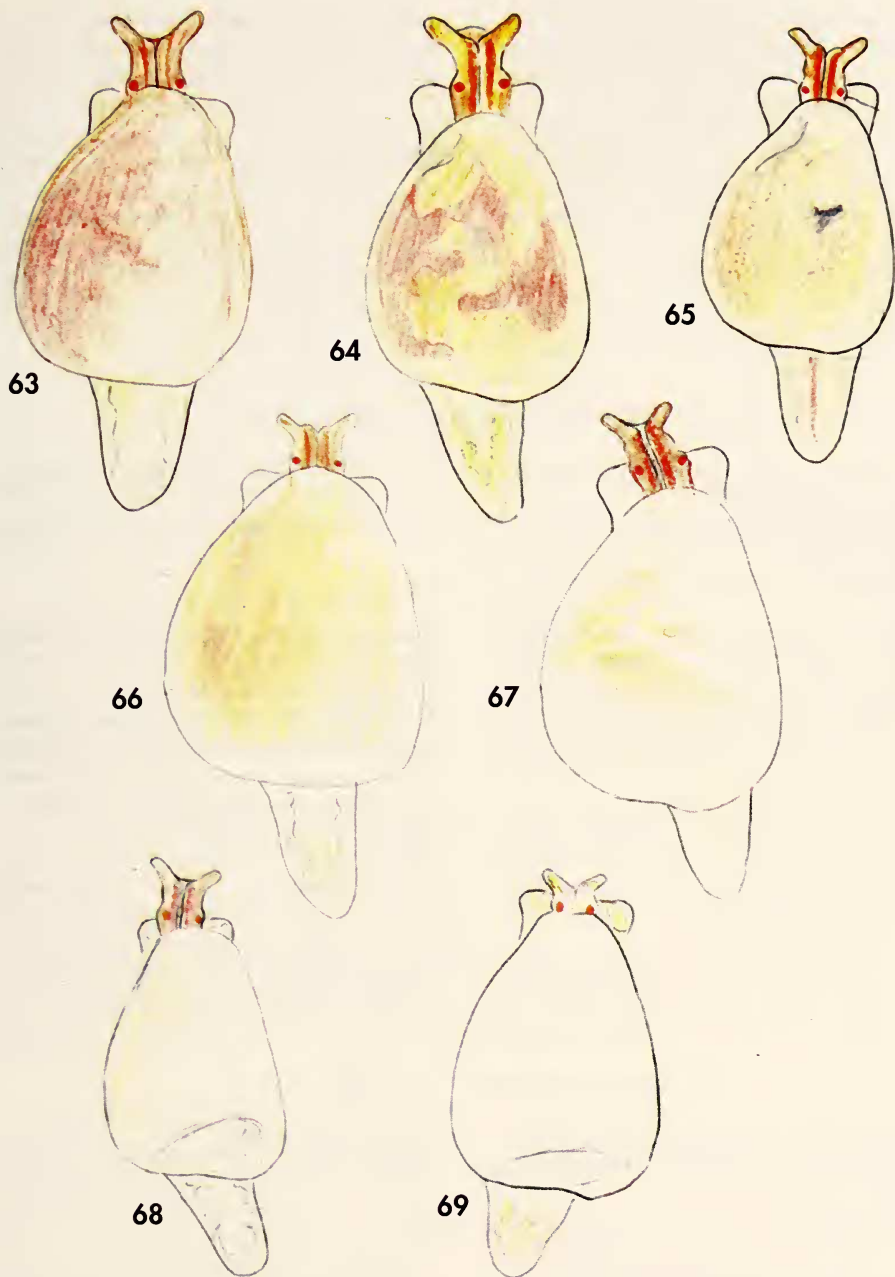
**Type locality:** Koumac area, Barrier Reef, stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, outer slope.

**Etymology:** From the leopard patterned inner mantle of the animal.

**Shell description** (Fig. 51): Translucent white, egg-shaped, inflated, faintly pyriform. Spire flat, labrum arched, inner lip smooth, three anterior columellar plaits.

**Size:** 1.55 x 1.00 mm.

**Animal description** (Figs. 72): Bifurcated head with short frontal lobes, foot small and triangular. Head fringed with light orange on a whitish and yellowish ground. Eyes red. Foot covered with large clouds of light yellowish to



Figures 63, 64: *Crithe caledonica*. 63: Koumac, stn 1316, (NC 657); 64: Touho, stn 1269 (NC 328).  
 Figure 65: *C. gofasi*, holotype, Touho, stn 1270 (NC 329). Figures 66, 67: *C. caledonica*. 66: Koumac,  
 stn 1318 (NC 648); 67: Touho, stn 1259 (NC 301). Figures 68, 69: *Cystiscus minor*. 68: Touho, stn  
 1259 (NC 302); 69: Touho, stn 1271 (NC 372).

*Figuras 63, 64: Crithe caledonica. 63: Koumac, stn 1316, (NC 657); 64: Touho, stn 1269 (NC 328).  
 Figura 65: C. gofasi, holotype, Touho, stn 1270 (NC 329). Figuras 66, 67. C. caledonica. 66: Koumac,  
 stn 1318 (NC 648); 67: Touho, stn 1259 (NC 301). Figuras 68, 69. Cystiscus minor. 68: Touho, stn  
 1259 (NC 302); 69: Touho, stn 1271 (NC 372).*

opaque white. Inner mantle light yellowish decorated with packed and disorganized small leopard-patterned greyish blue marks. The zone under the spire is light brown, surrounded by light yellow.

*Distribution*: Only known from 2 stations off Koumac, NW of NC mainland. Alive from 15 to 20 m.

*Habitat*: Not recorded.

*Remarks*: *C. pardus* sp. nov. is very similar to *C. goubini*. However, both

species were collected and observed in micro-sympatry (stn 1318) and they display constant differences. The shell of *C. pardus* is smaller and more rounded. The foot is yellowish to opaque white better than dirty white. The inner mantle has a yellow ground versus a greyish-blue one, and shows irregular fragmented greyish blue marks versus rounded whitish grey-blue ones. The head decoration is identical in both species, suggesting a close relationship.

### *Cystiscus deltoides* sp. nov. (Fig. 52)

**Type material**: Holotype (Fig. 52) in MNHN. Koumac, stn 1331. 1 paratype (ad sh) from the type locality, in MNHN.

**Type locality**: Koumac area, Great Reef, stn 1331, 20° 40' -20° 40.6' S, 164° 11.2' -164° 12.1' E, 55-57 m, outer slope.

**Etymology**: From the subtriangular outline of the shell.

*Shell description* (Fig. 52): Opaque white, light, slender, subtriangular, upper part inflated, tapering to the base. Spire flat, upper half part of the labrum arched, shoulder slightly elevated, lower half of the labrum oblique, inner lip straight and smooth. Three distinct anterior columellar plaits, eight visible small upper parietal varix. Aperture moderately narrowed, slightly widening to the base.

*Size*: 1.50 x 0.95 mm.

*Animal*: Unknown.

*Distribution*: Only known by one lot of two shells dredged off

Koumac, NW of NC mainland. Alive in 55 m.

*Habitat*: Not recorded.

*Remarks*: *C. deltoides* sp. nov. shows some similarities with *C. punctatus* as well as with the species described hereunder, as far as shell features are concerned. *C. deltoides* has however a more triangular outline than *C. punctatus*, and has a less slender outline and a less elevated labrum than the following species. *C. deltoides* may have a deeper bathymetric distribution than the other species studied herein.

### *Cystiscus caeruleus* sp. nov. (Figs. 53, 74)

**Type material**: Holotype (Fig. 53, 74) in MNHN. Touho, stn 1270.

**Type locality**: Touho area, Great Reef Mangalia, stn 1270, 20° 45' S, 165° 16.5' E, 10-35 m, outer slope.

**Etymology**: From the blue inner mantle of the animal.

*Shell description* (Fig. 53): Translucent white, light, slender, subtriangular, upper part inflated. Spire flat, upper part of the labrum arched and much elevated, central and lower labrum straight. Three distinct anterior columellar plaits, two small upper parietal varix. Aperture much narrow, hardly opened to the base.

*Size*: 1.7 x 1.0 mm.

*Animal description* (Fig. 74): Bifurcated head with short frontal lobes, foot small. Head and foot orange, inner mantle blue.

*Distribution*: Only known by 1 spm from Touho, NE of NC mainland. Alive in 10 m.

*Habitat*: Not recorded.



*Remarks:* The shell of *C. caeruleus* sp. nov. shows some similarities with *C. deltoides* and with the species de-

scribed hereunder. Its animal presents a much original bicoloured chromatism.

*Cystiscus tricinctus* sp. nov. (Figs. 54, 75)

**Type material:** Holotype (Fig. 54, 75) in MNHN. Touho, stn 1269. 4 paratypes (ad spm) from the type locality, in MNHN.

**Type locality:** Touho area, Doiman Reef, stn 1269, 20° 35.1' S, 165° 08.1' E, 15-20 m, outer slope.

**Etymology:** From the tribanded decoration of the inner mantle.

*Shell description* (Fig. 54): Translucent white, slender, light, suboval. Spire very small, low teat-like protoconch, upper labrum arched, shoulder moderately elevated, central and lower labrum straight, aperture narrow, faintly widening to the base, three columellar plaits.

*Size:* 1.60 x 0.95 mm.

*Animal description* (Fig. 75): Bifurcated head with short massive frontal lobes, foot small and triangular. Head light green, eyes red. Foot mottled opaque white. Inner mantle yellow with three black spiral bands, the anterior

one being U-shaped. External mantle translucent.

*Distribution:* Only known from one station in Touho, NE of NC mainland. Alive in 15 m.

*Habitat:* Not recorded.

*Remarks:* The shell of *C. tricinctus* sp. nov. shows some similarities with that ones of *C. caeruleus* and of *C. punctatus*. However, it is more oval and less shouldered than *C. caeruleus* and it is more slender than *C. punctatus*, with a narrower aperture. The animal of *C. tricinctus* is also much different from that one of these two species.

*Cystiscus pseudoaurantius* sp. nov. (Figs. 56, 77)

**Type material:** Holotype (Fig. 56, 77) in MNHN. Touho, stn 1255. 1 paratype (ad spm) from the type locality, in MNHN.

**Other material studied:** Expedition Montrouzier, Touho, 1993: stn 1270, 20° 45' S, 165° 16.5' E, 10-35 m, 5 ad spm; stn 1271, 20° 52.7' S, 165° 19.5' E, 5-25 m, 2 ad spm.

Expedition Montrouzier, Koumac, 1993: stn 1316, 20° 40' S, 164° 11.2' E, 12 m, 5 ad and 1 subad spm.

**Type locality:** Touho area, Ouao Islet, stn 1255, 20° 43' S, 165° 08' E, 11 m, sand, detritic domes.

**Etymology:** As distinct from *C. aurantius* a congeneric species which has also an orange coloured animal.

*Shell description* (Fig. 56): Translucent white, solid, subtriangular, wide. Spire hardly pronounced, upper labrum arched, shoulder slightly elevated, lower labrum straight, inner lip straight and smooth, aperture moderately narrow, faintly widening to the base, three strong anterior columellar plaits and a tiny fourth upper one.

*Size:* 1.9 x 1.3 mm.

*Animal description* (Fig. 77): Bifurcated head with long frontal lobes, foot medium sized, triangular. Head light orange with a wide red fringe along the central slit, frontal lobes red, eyes red.

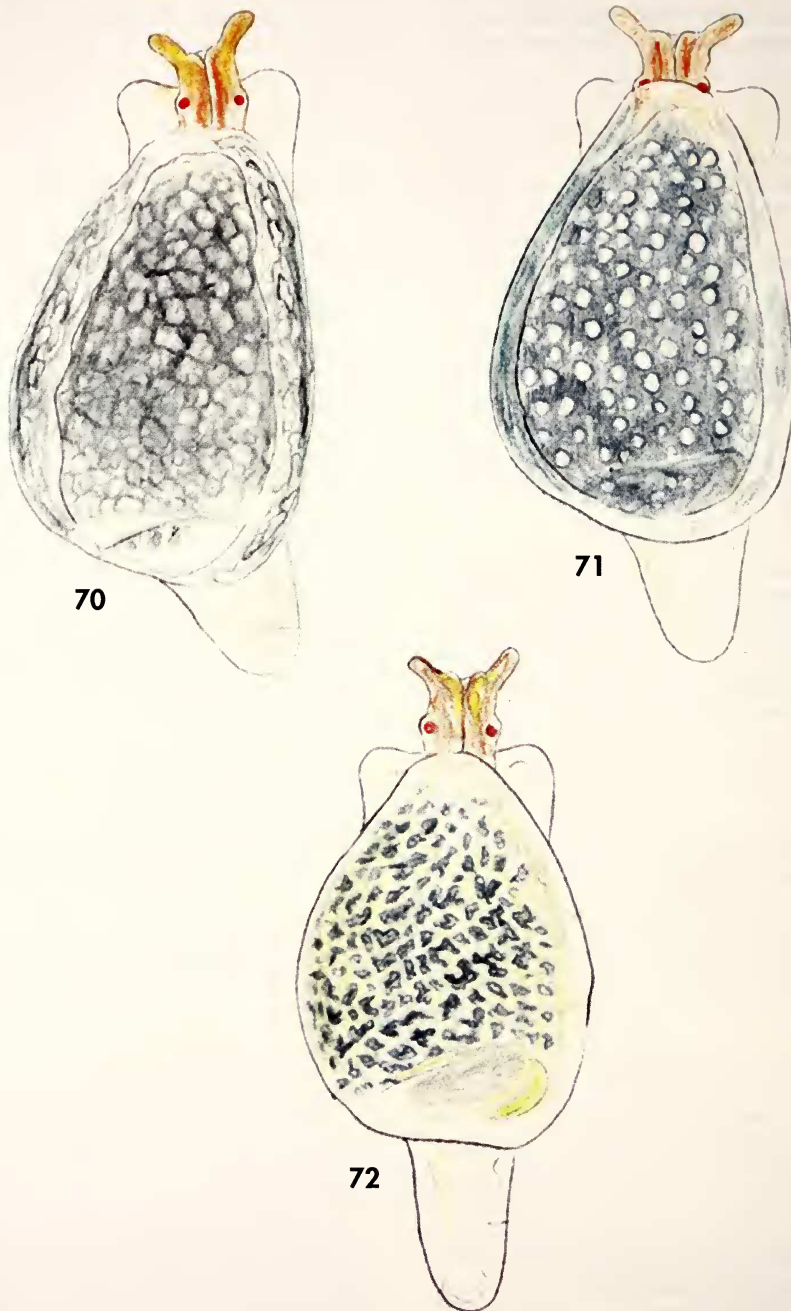
Foot and external mantle light orange, inner mantle beige.

*Distribution:* Known from Touho and Koumac, northern NC mainland. Alive from 5 to 12 m.

*Habitat:* The type material comes from detritic sandy places.

*Remarks:* The shell of *C. pseudoaurantius* sp. nov. is distinct from its relatives by its large size, wide and massive proportions, subtriangular rounded outline.

The animal is distinct from *C. aurantius* by the red marks on its head and by the deeper orange colour ground of both head and foot.



Figures 70, 71. *Cystiscus goubini*. 70: Touho, stn 1269 (NC 330); 71: Koumac, stn 1318 (NC 646).  
Figure 72: *C. pardus*, holotype, Koumac, stn 1318 (NC 647).  
*Figuras* 70, 71. *Cystiscus goubini*. 70: *Touho*, *stn* 1269 (NC 330); 71: *Koumac*, *stn* 1318 (NC 646).  
*Figura* 72: *C. pardus*, *holotipo*, *Koumac*, *stn* 1318 (NC 647).

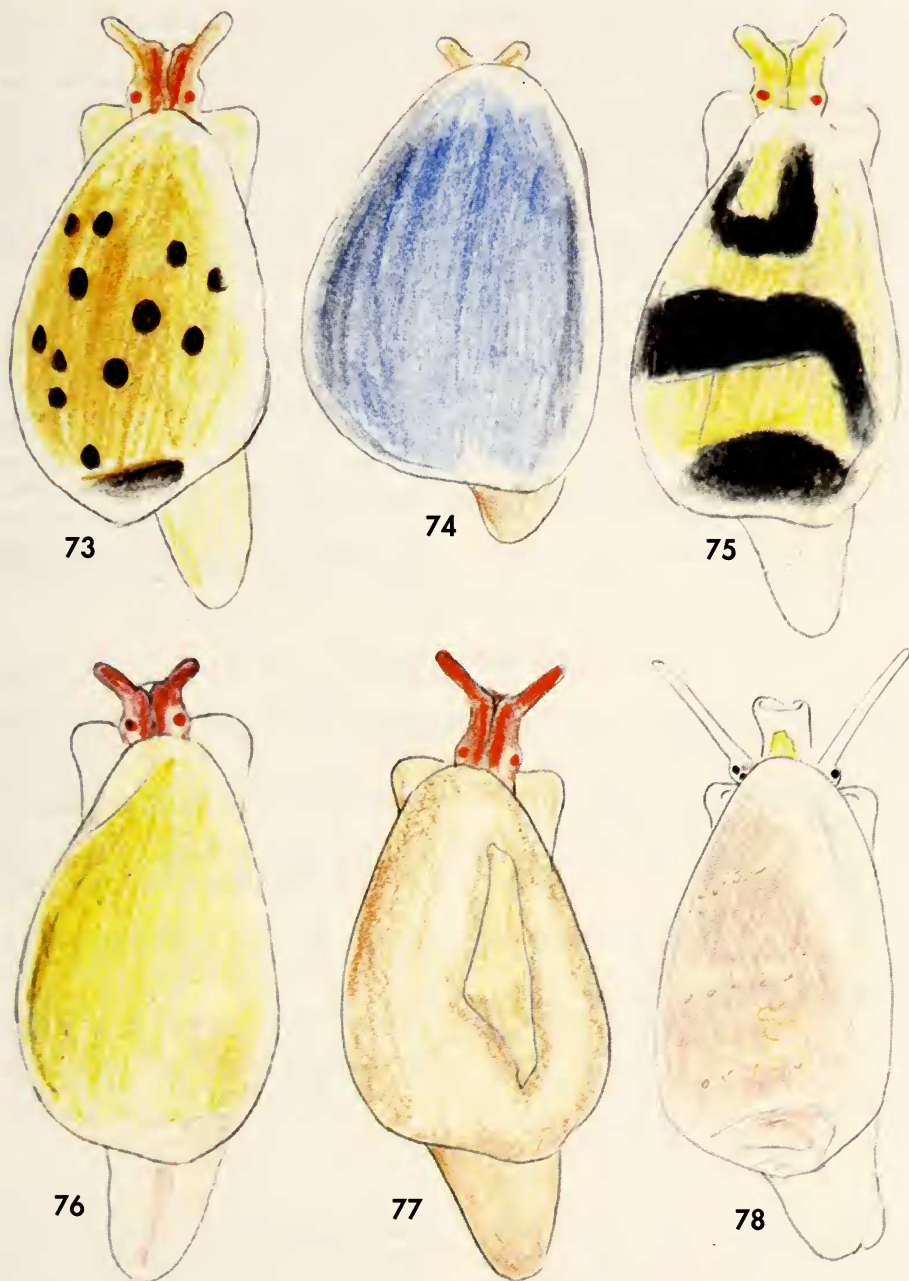


Figure 73: *Cystiscus punctatus*, Koumac, stn 1318 (NC 649). Figure 74: *C. caeruleus*, holotype, Touho, stn 1270 (NC 390). Figure 75: *C. tricinctus*, holotype, Touho, stn 1269 (NC 331). Figure 76: *C. marshalli*, Touho, stn 1272 (NC 348). Figure 77: *C. pseudoaurantius*, holotype, Touho, stn 1255 (NC 322). Figure 78: *Plesiocystiscus bavayi*, Touho, stn 1271 (NC 359).

Figura 73: *Cystiscus punctatus*, Koumac, stn 1318 (NC 649). Figura 74: *C. caeruleus*, holotipo, Touho, stn 1270 (NC 390). Figura 75: *C. tricinctus*, holotipo, Touho, stn 1269 (NC 331). Figura 76: *C. marshalli*, Touho, stn 1272 (NC 348). Figura 77: *C. pseudoaurantius*, holotipo, Touho, stn 1255 (NC 322). Figura 78: *Plesiocystiscus bavayi*, Touho, stn 1271 (NC 359).

*Cystiscus cooverti* sp. nov. (Fig. 57)

**Type material:** Holotype (Fig. 57) in MNHN. Koumac, stn 1312. 2 paratypes (ad spm) from the type locality, in MNHN.

**Other material studied:** Expedition Montrouzier, Koumac, 1993: stn 1310, 20° 39.7' S, 164° 14.9' E, 15 m, 3 ad spm; stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, 2 ad and 1 subad spm; stn 1319, 20° 44.7' S, 164° 15.5' E, 15-20 m, 1 subad spm.

**Type locality:** Koumac area, Pass, east cliff, stn 1312, 20° 40.4' S, 164° 14.9' E, 26-40 m, hard bottoms.

**Etymology:** For Gary Coovert, who devoted deep studies in marginellid gastropods during the last twenty years, and who made a first selection work on the material studied here.

*Shell description* (Fig. 57): Translucent white, light, slender oval, spire merging into the insertion of the outer lip, high shouldered arched upper labrum, lower part sinuous, narrow aperture slightly widening to the base, two anterior oblique columellar plaits, one upper subvertical third one.

*Size:* 1.40 x 0.85 mm.

*Animal:* Unknown.

*Distribution:* Only known from four stations in Koumac, NW of NC mainland. Alive from 15 to 26 m.

*Habitat:* Hard bottoms.

*Remarks:* Despite the unknown animal, the shell characters are sufficient here for a distinction at the specific level, based on the moderate size, the slender oval outline, the sinuous elevated labrum and the subvertical third columellar plait.

*Cystiscus bougei* (Bavay, 1917) (Figs. 58, 59)

*Marginella bougei* Bavay, 1917, p. 103-104, pl. II, fig. 3 (uncorrect picture). Bavay, 1922, p. 58, pl. I, Figs. 6-7 (correct pictures).

**Type material:** Lectotype (Fig. 58) in MNHN. Labels: "*Marginella (Granula) Bougei* cotypes. I<sup>s</sup> Wallis"; "*Marginella Bougei*. I<sup>s</sup> Wallis. types".

The lectotype was selected by ROTH and CLOVER (1973: 209), under ICZN (74b). Five other sh belonging to the same lot were later separated by G. Coovert as two *Cystiscus iota* (Hedley, 1899) and three *Cystiscus* sp.

One lot of 43 sh and fr was found in MDC (MNHN) with the labels: "*Ma Granula Bougei* I. Wallis Sables", from the hand of Bavay, and "TYPE" in typed red letters. These shells are now joined to the type lot as paralectotypes.

**Other material studied:** Expedition Montrouzier, Koumac, 1993: stn 1277, 20° 34' S, 164° 16' E, 0-2 m, 1 ad and 1 juv spm; stn 1279, 20° 35' S, 164° 15.5' E, tide, 10 ad and 4 juv spm (Fig. 59); stn 1282, 20° 33.5' S, 164° 13' E, tide, 1 ad spm; stn 1289, 20° 29.2' S, 164° 10.2' E, tide, 23 ad and 6 juv spm, 7 ad and 2 juv sh; stn 1292, 20° 22.4' S, 164° 06.8' E, tide, 2 ad and 1 juv sh; stn 1300, 20° 35.6' S, 164° 15.2' E, 10-11 m, 6 ad and 1 juv spm; stn 1303, 20° 37.7'-20° 38.8' S, 164° 15.9'-164° 17.1' E, 0-8 m, 1 ad sh; -Koumac area, Rat Islet, 20° 33.7' S, 164° 11' E, tide, 20 ad and 1 juv sh.

**Type locality:** Ouvea, Wallis Islands.

*Shell description* (Fig. 58): White, light, slender egg-shaped outline, tapering to the base. Outer lip sloping down in its upper part, thickened and bulging in its central part, slightly flexuous in its lower part. Long aperture, moderately widening to the base, three oblique columellar plaits.

*Size:* 1.4 x 1.0 mm.

*Animal:* Unknown. One of the spm from the stn 1279 is labelled as corre-

sponding to the drawing NC 639 by S. Gofas. However, this drawing shows an animal with well-pronounced rounded pustules on the external mantle, this character being common in *Granulina*, but not recorded in *Cystiscus*. The soft parts chromatism pictured in NC 639 matches the one of a species attributable to *Granulina* (BOYER, in press c). Furthermore, the foot of the dried animal said to be pictured in NC 639 clearly shows a festoon of black

patches, whereas such a decoration is not represented in NC 639. So, it seems evident that an inversion of sketches references led to the loss of the picture of *C. cf bougei*.

*Distribution:* North West NC to Wallis Islands. Alive from intertidal to 10 m, empty shells in intertidal. BAVAY (1917: 103) recorded a smaller form as ranging in Tonga Islands.

*Habitat:* Live spm are recorded from soft bottoms with grass.

*Remarks:* *C. bougei* appears as common and somewhat abundant in very shallow waters of Koumac, whereas it seems to be lacking in low tide brushings made off

Noumea and Touho. However, tide samplings seem to have been more frequent in Koumac. The shell variability observed in Koumac overlaps in the main the shell variability observed in Wallis.

The distribution of a species of *Cystiscus* from northern NC to Wallis and Tonga cannot be considered as impossible, even if the occurrence of the species in eastern NC, in Loyalty and in the New Hebrids remains to be verified. The control of the animal chromatism in the different places would help greatly to precise the taxonomic status of the populations attributable to *C. bougei*.

### Genus *Plesiocystiscus* Coovert and Coovert, 1995

Type species: *Marginella jewetti* Carpenter, 1857, by original designation.

#### *Plesiocystiscus tomlini* (Bavay, 1917) (Fig. 60)

*Marginella tomlini*, Bavay, 1917, p. 102-103, pl. II, fig. 7.

**Type material:** Lectotype (Fig. 60) and 3 paralectotypes (3 ad sh) in MNHN (ex-MDC). Labels: "Marginella Tomlini By Ouvea. I. Wallis, sables", from the hand of Bavay, and "TYPE" in typed red letters. No type material was found in MNHN by Clover (ROTH and CLOVER, 1973: 214).

**Other material studied:**

Expedition Montrouzier, Koumac, 1993: stn 1312, 20° 40.4' S, 164° 14.9' E, 26-40 m, 1 ad sh; stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, 1 ad sh.

**Type locality:** Ouvea, Wallis Islands.

*Shell description* (Fig. 60): White, solid, slender egg-shaped outline, spire short and faintly bulging, outer lip straight, aperture long and narrow, moderately widening to the base, three much oblique columellar plaits.

*Size:* 2.20 × 1.25 mm.

*Animal:* Unknown.

*Distribution:* Only known from Wallis Islands (type locality) and by the two comparable shells from Koumac, NW of NC mainland, sampled as empty shells from 20 to 26 m.

*Habitat:* Unknown.

*Remarks:* The two shells sampled off Koumac are slightly larger (L: 2.4 and 2.5 mm) than the types of *P. tomlini*, their columellar border is slightly more convex, and overall, they both present a small fourth columellar plait whereas the four types do not have.

Despite the fact that all the other shell features are similar in both phenae, they are probably distinct at a specific level.

#### *Plesiocystiscus bavayi* sp. nov. (Figs. 61, 62, 78)

**Type material:** Holotype (Fig. 61) in MNHN. Touho, stn 1261. 2 paratypes (1 subad spm and 1 ad sh) from the type locality, in MNHN.

**Other material studied:** Expedition Montrouzier, Touho, 1993: stn 1271, 20° 52.7' S, 165° 19.5' E, 5-25 m, 1 subad spm (Figs. 62, 78).

Expedition Montrouzier, Koumac, 1993: stn 1311, 20° 40.4' S, 164° 14.9' E, 10-60 m, 1 ad spm; stn 1314, 20° 39.8' S, 164° 15.3' E, 30-63 m, 2 ad sh; stn 1318, 20° 41.4' S, 164° 14.8' E, 20-30 m, 3 ad spm; stn 1319, 20° 44.7' S, 164° 15.5' E, 15-20 m, 1 ad spm; stn 1322, 20° 45.2' S, 164° 15.2' E, 53-71 m, 2 ad and 1 subad sh; stn 1331, 20° 40'-20° 40.6' S, 164° 11.2'-164° 12.1' E, 55-57 m, 2 ad sh. Expedition Lifou 2000: stn 1442, 20° 46.4' S, 167° 02.0' E, 47 m, 1 ad sh; stn 1449, 20° 45.8' S, 167° 01.65' E, 17 m, 1 ad sh.

**Type locality:** Touho area, channel, stn 1261, 20° 46'-20° 47' S, 165° 15'-165° 16.5' E, 45-56 m, detritic sand.

**Etymology:** For Arthur Bavay (1840-1923), french conchologist who specially devoted to the study of small marginelliform gastropods in the earl XX<sup>th</sup> Century, and who performed the first revision of cystiscids from New Caledonia.

*Shell description* (Fig. 61): White, slender tear-shaped, upper part inflated, spire very small, rounded, aperture narrow, slightly widening to the base, inner lip long, straight and smooth, four distinct oblique columellar plaits, a fifth subvertical one is suggested.

*Size:* 3.30 x 1.95 mm.

*Animal description* (Fig. 78): Bilobed head, with two long tentacles, black eyes at their base on a swollen peduncle. Siphon wide and produced. Foot large and subrectangular. The back tip of the metapodium is truncated. Mentum distinct ahead of the foot.

Head, siphon and foot whitish translucent. A small orange stain and a black one at the level of the eye, a

yellow patch at the centre of the siphon. Inner mantle light reddish with three spiral rings of yellow dots.

*Distribution:* Known from Touho and Koumac, northern NC mainland. Alive from 5 to 45 m, empty shells from 17 to 55 m.

*Habitat:* Detritic to silty sand as well as hard bottoms.

*Remarks:* One larger shell from Koumac (stn 1322, 53-71 m), sizing 3.75 mm in length, shows noticeably distinct features (more slender and cylindric outline, less opened aperture to the base, more concave first columellar plait, more produced spire), and must be provisionally considered as belonging to a different species, as *P. sp. aff. bavayi*.

## CONCLUSION

In the course of this study, 28 morphs were recognized as belonging to the sublittoral Cystiscidae from NC mainland. Among them, 5 are referred to species previously described (one being referred with much reserves), 18 are described and named as new species, and 5 are recorded as potential new species. As such, the known diversity of the sublittoral Cystiscidae from NC is increased by a factor higher than x5.

Nineteen of these 28 morphs belong to the group *Crithe/Cystiscus*. It can be assumed that much more species belonging to this group remain to be discovered at infralittoral levels from NC, by the fact that most of the species are represented by a very limited number of lots and subjects within the

important material checked here. As far as the group *Crithe/Cystiscus* is concerned, eight morphs are represented by only one lot (six morphs by only one or two subjects), three morphs by only two lots, and only eight morphs among nineteen are represented by more than two lots.

In other words, the majority of the morphs belonging to *Crithe/Cystiscus* are represented by only one or two lots, and 30% of the total morphs are represented by only one or two subjects. From these elements, it can be inferred that the "sampling saturation" is far to be reached, and that deeper investigations within the sampled areas will very probably procure many new morphs.

The species composition does not show any evident correspondence with

the special environmental features represented within the four studied sites, and the results suggest that the endemism is very developed in NC *Crithe/Cystiscus*: among the nineteen studied morphs, ten are represented only from northern NC, six only from SW NC, and only three are represented in northern as well as southern stations (overlapping rate of only 16%). Even if it can be supposed that the number of widespread morphs is underestimated, the results allow to infer that some of the species may have a distribution restricted to few hundred kilometres of coast. As a consequence, each of the wide coastal zones which were not intensively checked (central West Coast, central and southern East Coast, Ile des Pins, far north lagoon and Belep Island) may shelter a set of endemic species.

In these conditions, the diversity of *Crithe/Cystiscus* displayed in this article cannot be considered as representative of the real diversity of this group in NC waters, which is probably much higher. It must be only considered as an indicator demonstrating that the group *Crithe/Cystiscus* is highly diversified in NC waters, and as a stimulating pretext to develop intensive samplings in other places of the NC coast, to intensify locally the sampling for a measure of effort/diversity output, and to correlate the faunal diversity at hand with the diversity of its sheltering micro-habitats in view to infer the real faunistic diversity.

The best use of the observations about the diversity is probably to play it as an argument in the reconstruction of an evolutionary history or as explanatory of a biogeographic context: this supposes appropriate ways and degrees of observations. In the case studied here, the principal deficiencies of the information seem to lie in the fact that micro-habitats attached to each species are not recorded (assessment of the sampling impact correlated to the micro-habitat diversity) and in the relative few number of live animal pictures compared to the high number of specimens collected (assessment of the global vari-

ability of the species and control of the specific diversity). In the case of *Cystiscus/Crithe*, made of numerous species with very similar shells but with very different and non-variable animals, the knowledge of the animal chromatism and external morphology is decisive for estimating the diversity at the specific level. In the case of the small white shelled *Gibberula*, that is the important variability of the shells and of the animals of some species which makes necessary to have recourse to the systematic observation of the live animals. Consequently, the best exploitability of the intensive samplings seems to require the notation in the field of precise data about the sampled micro-habitats, and the organization of intensive picturing of live animals.

The diversity of *Crithe/Cystiscus* observed in NC cannot be considered no more as a special occurrence restrictively attached to this area. In fact, the situation revealed in NC may as well be representative of a high diversity of *Crithe/Cystiscus* in Central West Pacific. The intensive samplings realized recently in NC constitute an innovation, and the rest of the Central West Pacific (even the intertropical australian coasts) waits for such a performance.

On the ground of the various morphs studied here, the genera *Crithe* and *Cystiscus* do not show as clearly distinct. It better seems that they both belong to a wide complex of forms which deserves to be unified under a common taxonomic group. However, this wide group will probably require taxonomic subdivisions corresponding to natural affinities, and it is conceivable that the generic unification of the group will be more correctly stated in the frame of a general reorganization rendering the diversity pattern working here.

## ACKNOWLEDGEMENTS

Thanks are due to the members of the Expeditions Montrouzier 1993 and Lifou 2000 field parties, and in particu-

lar to Philippe Bouchet (Paris Museum) and to Serge Gofas (University of Malaga) for performing accurate observations and precious sketches about live animals in the field.

I am also indebted to Yves Finet (Geneva Museum) for the pictures of *Gibberula pulchella* syntypes, to Philippe Maestrati (Paris Museum) for the creation of the digital plates, and to Robert

and Nicole Hasselot (Jouques, France) for typing out the text.

Guido Poppe (Antwerpen, Belgium) supported the extra cost of the colour pictures.

A special acknowledgement is due to Maxime Desjardins (Paris, France), who deposited the Bavay's marginellids collection in Paris Museum, allowing to revise several taxa in appropriate conditions.

## BIBLIOGRAPHY

- BAVAY, A., 1917. Quelques coquilles des sables littoraux de divers pays. *Journal de Conchyliologie*, 63 (2): 91-114, pls 2-3.
- BAVAY, A., 1922. Coquilles des sables littoraux marins. *Journal de Conchyliologie*, 64 (1): 57-65, pl. 1.
- BOUCHET, P., 1994. Atelier Biodiversité Récifale. Expédition Montrouzier. Touho-Koumac, Nouvelle-Calédonie, 23 août-5 novembre 1993. *Rapports de missions, Sciences de la mer, Biologie marine*, ORSTOM-Nouméa, 24: 1-63.
- BOYER, F., in press a. Le groupe *Gibberula frumentum* (Sowerby, 1832) dans l'Atlantique occidental. *Novapex*.
- BOYER, F., in press b. Description of a new *Cystiscus* (Gastropoda: Cystiscidae) from Mascarene Islands. *Journal of Conchology*.
- BOYER, F., in press c. Les genres *Granulina* et *Dentimargo* (Gastropoda: Marginellidae) dans l'infralittoral de la Nouvelle Calédonie. *Novapex*.
- COOVERT, G. and COOVERT, H., 1995. Revision of the Supraspecific Classification of Marginelliform Gastropods. *The Nautilus*, 109 (2-3): 43-110.
- CROSSE, H., 1871. Diagnoses Molluscorum Novae Caledoniae. *Journal de Conchyliologie*, 19 (3): 201-206.
- CROSSE, H., 1872. Descriptions d'espèces inédites de la Nouvelle-Calédonie. *Journal de Conchyliologie*, 20 (3): 218-222, pls 2-13.
- GOFAS, S., 1990. Le genre *Gibberula* (Marginellidae) en Méditerranée. *Lavori della Società Italiana di Malacologia*, 23: 113-139.
- HEDLEY, C., 1899. The Mollusca of Funafuti, Part I: Gasteropoda. *Memoirs of Australian Museum*, 3 (7): 397-488.
- KIENER, L. C., 1834. *Spécies général et Iconographie des Coquilles vivantes. Genre Marginelle*. Pp. 1-30, pls 1-9. J.B. Baillière et fils, Paris.
- ROTH, B. AND CLOVER, P. W., 1973. A Review of the Marginellidae described by Bavay, 1903-1922. *The Veliger*, 16 (2): 207-215.